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VOLUME XIV DECEMBER 28, 1925 NUMBER 22

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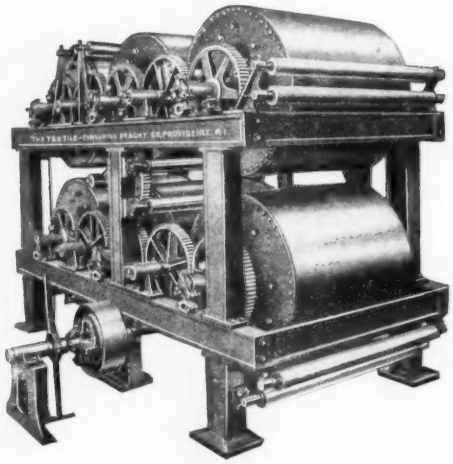

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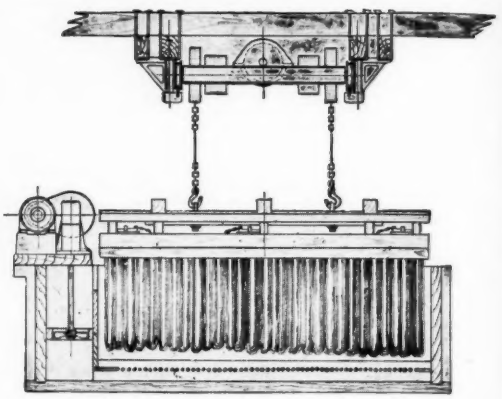

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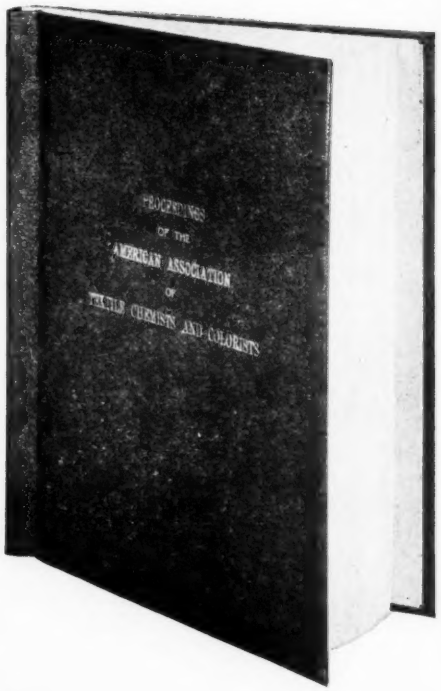

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Charles E. Mullin

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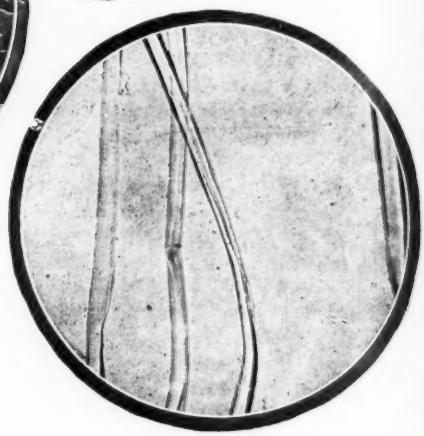
The photomicrograph at the right shows how clean the fibres come out when degummed in properly conditioned water. Clean fibres like these will make quality products.



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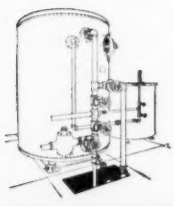

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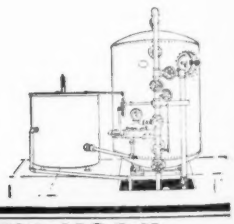

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VOLUME XIV NEW YORK, DECEMBER 28, 1925 NUMBER 22

Acetate Silk—Its Dyes and Their Application

Part III

SUPPLEMENTAL TO THE PRECEDING SERIES OF ARTICLES ON DYEING ACETATE SILK

Notes on Mordant and Acid Dyes With References to Patent Literature

By CHAS. E. MULLIN, M. Sc., F. A. I. C.

(All rights reserved by author)

THE acid and mordant dyes, if we include the azo dyes in this group, have recently taken a very important place among the dyes for acetate silk. If we also include in this group (mordant) many of the anthraquinone direct dyes prepared especially for acetate silk, and which are not suitable for application by the usual "vat" methods, the importance of this group is even further increased. This classification brings many of the most recently announced acetate silk dyes into the acid and mordant group. The application of the acid and mordant dyes was discussed in Part V of this series, but recent information greatly increases the importance of this class of products.

It is well known that the sulphonic acid group or groups confer solubility in water to many otherwise insoluble dyes and other organic chemical products. At the same time these groups decrease the solubility of the sulphonated compound in organic solvents. As pointed out in the original series, the dyeing of acetate silk in many ways appears to resemble a solution phenomenon, such as the solution of the dye in an organic solvent, as for instance paraffine. Therefore we can readily see why the sulphonic acid group is not always desirable in dyes for acetate silk. On the other hand, carboxylic groups also confer solubility in water to some extent, without at the same time materially reducing the solubility of the carboxylated compound in organic solvents or acetate silk. At the present time, on account of the unknown composition of the recently announced acetate silk dyes, it is impossible to identify those belonging to the different types, but it is highly probable that some of the new products in powder form are azo dyes, some of which are carboxylated.

The extent to which the sulphonic group affects the solubility of the sulphonated compound in acetate silk or organic solvents depends not only upon the number of sulphonic groups present, but also upon their orientation, as well as the other radicles present in the molecule (see British Patent No. 226,948). For this reason it is possible to apply certain monosulphonated dyes to acetate silk, as was mentioned in the case of Alizarine Saphirol under the Celatene dyes.

Recent information on the Duranol and Celatene dyes indicates that these dyes are anthraquinone products. Some of the simpler anthraquinone derivatives, such as those of the acid alizarine series of dyes are solubilized by sulphonating either the anthraquinone nucleus or the attached arylamino groups. This is understood to be the basis of the Celatenes and Duranols. However, when the more complex anthraquinous derivatives, such as the vat dyes are sulphonated, the solubility is decreased instead of increased. The carboxylic acid and certain basic groups which have been used in solubilizing some other classes of dyes, are of little use in sollubilizing the more complex anthraquinone derivatives. Indanthrene Blue WB (C. I. No. 1093) is a sulphonated and anthraquinone vat dye which is somewhat soluble in hot water.

While some of the dyestuffs used in the preparation of the dispersal pastes may be either sulphonated or unsulphonated azo compounds, the former resembling acid dyes in constitution, the sulphonated anthraquinone compounds more nearly resemble the mordant dyes; while some unsulphonated anthraquinone products approximate the vat dyes in constitution. Very possibly some of the products covered by the following patents may be applied by the dispersal method, discussed in Parts XI, XII, XIII, and XIV; however, many of them may be applied to acetate silk in the same manner as acid, mordant or direct dyes.

According to British Patent No. 224,363, October 25, 1923, to the British Dyestuffs Corporation, Baddiley and Tatum, anthraquinone dyes which are very soluble in

water, dilute acids or alkalies, may be prepared from a suitable aminoanthraquinone by condensation with an alkylene oxide carboxylic acid in glacial acetic acid, with or without the aid of a catalyst, such as copper. For example 10 parts of 1, 4-diaminoanthraquinone are suspended in 100 parts of glacial acetic acid and 0.5 part of copper acetate, and 20 parts of methylglycidic acid added. After stirring two days at room temperature, the whole is poured into 2,000 parts of water, the solution neutralized with caustic soda, 100 parts of salt added, and filtered. The dyestuff is salted out from the filtrate and forms a blue powder on drying. The product dyes wool very bright shades of good general fastness, as well as dyeing acetate silk. The dyes obtained from methylglycidic acid or the potassium salt of phenylgylcidic acid and 1, 4-diaminoanthraquinone give blue shades; while the latter acid gives a red dye with *a*-aminoanthraquinone; or a purple dye with *a*-amino-4-hydroxyanthraquinone.

British Patent No. 201,610, April 28, 1922, to J. Baddiley, W. W. Tatum and the British Dyestuffs Corporation covers new acid and acid-mordant wool dyestuffs of the anthraquinone series which may have some affinity for acetate silk. This patent is referred to in British Patents No. 207,711 (page 316, Part V) and No. 225,678, which follows. Patent No. 201,610 states that wool dyestuffs of excellent fastness to milling and washing are obtained by the condensation of amino-derivatives of anthraquinone with the sulphochloride of salicylic acid, either with or without a condensing agent. For example, a blue dyestuff is produced by heating a mixture of 27 parts of tetra-aminoanthraquinone, 25 parts of salicylic sulphochloride, 17 parts of fused sodium acetate and 210 parts of nitro-benzene at 135 deg. Cent. for three hours, freeing the product from nitrobenzene by steam distillation and precipitating the dyestuff with salt.

British patent No. 225,678, October 23, 1923, another addition to No. 201,610 and to the same inventors, describes the manufacture of other dyes by substituting the sulphochlorides of other *o*-hydroxycarboxylic acids, such as *o*-cresotic acid, for the salicylic sullphochloride of the principal patent. For instance, 10 parts of 1, 4-diaminoanthraquinone, either dissolved or suspended in 60 parts of acetic acid, are stirred with 12 parts of *o*-cresotic sulphochloride at 60 deg. Cent. (140 deg. Fahr.) for four hours, during which time four parts of anhydrous sodium acetate are gradually added. After the separation of the dye, it is converted into its sodium salt, the solution filtered from the uncondensed diamine, and the dyestuff salted out. This product dyes wool a bluish-red shade and has a high affinity for acetate silk.

British Patent No. 226,948, November 30, 1923, to the British Dyestuffs Corporation and G. H. Frank covers the use of monosulphonated azo dyes which do not contain hydroxyl groups, and have this sulpho group in the ortho-position to an azo group. Monoazo dyestuffs prepared by combining an unsulphonated diazo compound, containing no hydroxy groups, with naphthylamino-sulphonic acid or its phenyl or other derivatives, also have an affinity for acetate silk. A hydroxyl group is capable of increasing the activity of the sulpho group to such an extent as to diminish the affinity of the dye for acetate silk.

In this manner acetate silk dyes may be obtained by coupling diazotized *p*-nitroaniline-*o*-sulphonic acid or diazotized 2, 1-naphthylamino-sulphonic acid with *N*-alkyl or *N*-aryl substituted amines, particularly substituted naphthylamines, or with *m*-toluylenediamine. For instance, the products from diazotized *p*-nitroaniline-*o*-sulphonic acid combined with phenyl-*a*-naphthylamine (brown), *p*-tolyl-*a*-naphthylamino (brown), ethyl-*a*-naphthylamine (orange brown), ethyl-*B*-naphthylamine (violet), phenyl-*B*-naphthylamine (violet), *a*, *a'*-dinaphthylamine (brown), or *B*, *B'*-dinaphthylamine (bluish-violet), have a high affinity for acetate silk. By the reduction of the nitro group and coupling with a *m*-diamine, other valuable dyes are obtained. Other acetate silk dyes mentioned and which contain sulpho groups in the peri position to the amino or substituted amino group, are *p*-nitroanilineazo-1, 8-naphthylaminesulphonic acid (peri acid) and *p*-nitroanilineazophenyl-peri acid. These dyes are applied to acetate silk from a slightly alkaline dye bath. Also see United States Patent No. 1,534,506.

United States Patent No. 1,534,506, April 21, 1925, to G. de Montmollin and G. Bonhote, assignors to the Society of Chemical Industry in Pasle, covers the preparation of azo dyes for acetate silk. According to this patent nonhydroxylated nitrodiazo compounds are coupled with aromatic monoamines of the benzene series not derived from metanilic acid, and substituted at the nitrogen atom by a residue containing a benzene nucleus to yield dyestuffs of the general formula $NR_1:NR_2R_3R_4$, in which R_1 represents a nonhydroxylated benzene nucleus carrying at least one nitro group; R_2 a benzene nucleus not having any sulphonic acid group attached in the ortho-position to the azo groups; R_3 a residue containing a benzene nucleus; and R_4 hydrogen or alkyl; and in which only one of R_1, R_2 or R_3 contains one sulphonic acid group. These dyestuffs dye acetate silk in a slightly acid or neutral bath yellow to bluish-red and brown tints of good fastness to washing, and of good to very good fastness to light. For example, diazotized 2, 4-dinitroaniline coupled with *N*-ethyl-*N*-*p*-sulphobenzylaniline gives a product which dyes acetate silk in fast bluish-red shades from an acetic acid dye bath. The product from diazotized 2, 6-dichloro-4-nitroaniline and diphenylaminesulphonic acid gives orange tints, while that from *m*-nitroaniline and benzylanilinesulphonic acid gives yellow shades.

According to British Patent No. 228,557, January 29, 1924, to Meister, Lucius & Bruning, acetate silk may be dyed violet to blue shades by monosulphonated 1, 4-diaminoanthraquinone or 1, 4-aminohydroxyanthraquinone, or an alkyl, aralkyl or aryl derivatives of these compounds, having the sulpho group in the 2- or 3- position. The

(*Continued on page* 893)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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Lowell Textile School, Lowell, Mass.

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FIFTH ANNUAL MEETING
SATURDAY MORNING SESSION
December 5, 1925

The Saturday morning session of the Fifth Annual Meeting convened in the Walker Memorial, Massachusetts Institute of Technology, Cambridge, Mass., at 9.45 a. m., Prof. Louis A. Olney, President, presiding.

President Olney—Our business meeting this morning brings to a close the fourth year of our Association, and I think we may all look back with some pride and satisfaction upon its growth during that period, not only as to increase in number of members and geographical extension, but also because of the recognition it has received from the various scientific and technical associations of the country, and also from many of the manufacturing and trade associations. I believe as time goes on our Association is going to increase in the estimate of its value in the eyes of the textile industry.

The various reports which will be presented this morning will advise you in regard to the progress of the Association. We had some hesitancy in calling the meeting at this early hour, but we have a long program to cover to-day and if we had not done this it would have been a difficult matter to complete it. We are pleased, however, to see as many as we have here at this time, and we will not delay the meeting any longer.

In accordance with our By-laws, the ballots of the Association are turned over to the President in order that they may be officially counted, and I will appoint Mr. Thompson and Mr. Steele as the tellers. If they wish, they can take one of the small tables and bring it right in here somewhere so that they will not miss any of the meeting.

I might say that these ballots are all in the envelopes just as they were received. The Secretary found, however, that it was necessary to tear open the envelopes, simply because in past years sometimes twenty or thirty of the reply postal cards instead of being mailed had been put into the envelopes, with other data as to members' attendance at the meetings. Sometimes checks for the reservations at the banquet were included in those envelopes. That explains why the envelopes were opened. The Secretary, however, has not looked at any of the ballots. I think under the circumstances he was justified in handling the matter as he did.

The report of the Secretary is our first item of business. We will hear from Mr. Hadley.

Secretary's Report
For the Year Ending December 5, 1925

The Council of the American Association of Textile Chemists and Colorists have held seven meetings since the last Annual Meeting in Philadelphia in 1924.

Six of these meetings were held in Boston, and one in New York City.

The Research Committee have held four meetings in Boston and one in New York City, and a great amount of work has been done by sub-committees.

An increasing interest in the work of the Association is manifest among the manufacturers, and this year we have added several new names to the list of corporate members.

The local sections have all shown a healthy growth, which promises well for the future welfare of the Association.

The membership consists at the present time of 673 active, 174 junior, and 8 corporate members. Several names have been dropped during the past year for non-payment of dues, leaving a total membership of 855. Six Juniors have been transferred to Active Membership.

I might add that yesterday at the Council meeting we accepted some fifteen to twenty Active Members and four more Juniors, which will raise the total for this year, which will appear in the next annual report.

President Olney—You have heard this report. Are there any corrections, criticisms or remarks with regard to it? If not, it will be accepted and approved and placed on the records, unless there are objections. I hear none, and it is so ordered.

Our Treasurer doesn't appear to have arrived as yet, so we will have to postpone his report. He may be out spending that $4,000 that seemed to worry him so much last night. (Laughter.)

I am going to present a rather brief report for the Research Committee, of which I am Chairman.

Report of Research Committee

Submitted by Prof. L. A. Olney, Chairman

As yet the chief work before the Research Committee is the formulation of standard methods of dye testing.

During the year a number of revisions have been made and methods for fastness to carbonizing and fastness to sea water have been added.

The Committee on Fastness to Light has probably done more experimental work than any of the other committees, but they have been confronted with so many obstacles in the way of irregularities both on the part of the lights used and variation of the action of the dyes themselves in the same light that they have not up to now been willing to submit any method which they consider sufficiently final for adoption.

Mr. Cady, the chairman of the Sub-Committee on Fastness to Light, will report more definitely in regard to work of his committee in a few minutes.

During the past year much time and thought has been spent in an endeavor to correlate the various methods, particularly of fastness to washing, to the requirements of the consumer as well as to those of the textile manufacturer.

In this work, William D. Appel, of the United States Bureau of Standards, has rendered very valuable assistance, and I think he might well be designated as the chairman of a subcommittee on correlation. We are endeavoring to co-operate with the Bureau of Standards in such a way that our methods when presented in their final form will receive its full approval.

Another important work being undertaken by the committee is an endeavor to secure the co-operative criticism of various technical laboratories in a check-up of our fastness methods as already proposed. A rather extensive set of dyed samples, including cotton, wool and silk, are being sent to at least ten different laboratories, representing manufacturing, dyestuff, distributing and consuming interests, with the request that they endeavor to give these dyed samples the proper classification. In that way we hope to check up on the reliability of our suggested procedure of manipulation. These testing agencies are also being asked to call our attention to any weak points they may have found in our methods.

The possibility of co-operation with the British Society of Dyers and Colourists in the matter of fastness tests has also been suggested, and in fact, correspondence is being conducted at the present time with the object in view of determining the feasibility of the establishment of a series of fastness tests which shall be uniform for both England and the United States.

Another type of work being undertaken by our Research Committee will be directly illustrated by the three contributions, Numbers 1, 2 and 3, by our Research Committee, which will be reported at the close of the business meeting. Work is also being carried on in connection with the subject of wool oils, but this has not progressed sufficiently as yet to warrant a definite report.

In our Year Book mention is made of the fact that a prize of $100 will in the discretion of the Council be given to the one presenting the best paper in our Proceedings during the previous year. There has been too little time for the Committee to definitely report in regard to this, but they will report at an early date. The Committee which has been appointed for that purpose consists of W. H. Cady, as chairman, Dr. E. H. Killheffer, W. R. Moorhouse, P. J. Wood, and W. S. Williams.

We are always open to suggestions in regard to the work of the Research Committee. We wish in every way to conduct it so that it will be of the greatest service to the members and the textile industry which it represents. I might say that at our Council meeting yesterday several appropriations were made, or considered, to extend the work of the committee, and we are sure that sooner or later the results of this fund which we are collecting for the purpose of research will show that the contributions

which have been made for that purpose have really been worth while. In the meanwhile, we are mapping out a program which we hope in the comparatively near future may be carried out much more extensively, and for the support of this work we are depending very largely upon the funds which come from our corporation members. So that any interest the members of the Association may take in securing corporation members will be a direct contribution to the work of our Committee.

We will now listen to reports of sub-committees. The first one will be the report of the Sub-Committee on Light Fastness, by Mr. Cady.

Report of the Sub-Committee on Light Fastness

Submitted by Sub-Committee Chairman William H. Cady

During the past year your Committee has continued its investigation into the fading of dyes, with the object of devising some standardized method of testing the fastness of dyes to light. This investigation has proceeded along several lines.

A large number of exposures to sun and sky have been made, using a series of twenty dyeings representing a great variety of dyes and dyeing methods, some on wool, some on cotton, some on silk. We wished to determine to what extent sun-fading is influenced by such factors as the angle of exposure, the presence or absence of a glass shield, free circulation of air about the exposed portion, exposing the samples twenty-four hours a day or only during the hours when the sun is high, the difference between sun-fading and sky-fading (without sun), and the difference between exposures made under the same conditions in different localities, and in the same location at different seasons of the year. A large amount of data has been collected covering these various points, from which the following conclusions have been drawn:

1. The angle of exposure is important. Identical exposures made at 45 deg., horizontal and vertical, all under glass facing south, showed slightly more total fading in the horizontal exposure than in the one at 45 deg., while the vertical exposure was the least faded. There was little difference in the *relative* fading of the individual samples, however.

2. The presence of glass over the samples has considerable influence on the quality of the fading. Two exposures were made, identical except that one was glass-covered and the other open (but not exposed to rain). Of the twenty samples, nine showed appreciably more fading in the open, ten showed no difference, while one was more faded under glass.

3. The effect of free circulation of air or lack of it in exposures under glass may be considerable and cannot be ignored. Two exposures were made, in one of which the samples were pressed tightly between the glass cover and the pasteboard backing, while in the other there was an open air space surrounding the exposed portions. Six of the twenty samples faded slightly more in the set where the air circulated, while four faded decidedly more in the set without circulation.

4. Continuous exposure produces somewhat different fading from exposure only to the sun while it is high and free from clouds. One set was exposed day and night for nine days, and the other between the hours of 9 a. m. and 3 p. m. on sunny days only, for a somewhat longer period. Six of the samples faded about equally in the two sets. The rest showed more fading in the continuous exposure, the difference in three instances being extremely marked.

5. Direct sunlight has a different effect from "skylight" without sun. Two identical sets were exposed, one to sun and the other to cloudy sky, the exposures being alternated according to the weather. Six of the twenty samples faded relatively more under the cloudy sky, while two faded more under the sun. The remaining twelve were about equal in the two sets.

6. Exposures made in different localities show little variation in the *relative* fading. This was demonstrated by tests made in Washington, D. C., Fall River, Mass., South Manchester, Conn., and Auburn, N. Y., under practically identical conditions. This work is being continued to include localities in the extreme North and South.

7. Exposures made in the same location at different seasons of the year show little variation so far as our experiments have gone, but these tests are not yet completed.

From the above it will be seen that the old reliable "sun tests" may at times be quite misleading, and it seems desirable that all who continue to use the sun as a fading agency should come to some agreement as to the precise manner in which sun tests should be made. As a basis for discussion, your Committee suggests the following specifications: All samples should be exposed at an angle of 45 deg., facing due south, between the hours of 9 a. m. and 3 p. m. on sunny days only, in a cabinet covered with a good grade of window glass approximately one-eighth of an inch thick, and open at the sides in such a way as to allow free circulation of air over the samples. The distance between the samples and the glass should be approximately 1 inch. A portion of each sample should be protected from the light by opaque material.

For those who desire a "weather test" in which the effect of both light and rain on the samples is desired, the above procedure will, of course, be unsuitable. It is recommended for those who wish to determine fastness to light alone, and should always be made

comparative by including in the exposure a sample of known fastness.

It has been proposed that sun-fading tests could be put on a quantitative basis by measuring the total number of foot-candle-hours of light actually required to fade a dyeing, the idea being that the same quantity of radiant energy should always produce the same amount of fading regardless of weather conditions or seasonal fluctuations in the intensity of the light. The Case photo-electric cell was suggested for this purpose, and we used it to measure the light during the progress of several of the sun and sky tests, including intermittent exposures to both sun and cloudy sky and continuous exposures to both north and south light. In general, it was found that the quantity of light falling on the samples during exposure, as recorded by the cell, did not correspond with the amount of fading produced. The difficulty does not lie in the Case cell itself, which appears to work quite satisfactorily, but is perhaps due to the fact that environmental influences, such as moisture and gases in the atmosphere, which do not affect the cell, have a marked effect on the rate of fading of dyeings.

Your Committee has continued its work with artificial illuminants. Exposures were made in three lamps of the violet carbon arc (fade-ometer) type, in as many localities, two complete sets of dyeings being faded in each lamp for forty hours, in order to determine the variations, if any, caused by fluctuations in voltage, amperage, humidity, etc. No appreciable variation in the *relative* fading of the samples was observed, although there was some variation in the *total* fading. A comparison of these violet carbon arc exposures with the sun tests previously described shows much difference in the quality of the fading, at least nine of the twenty samples behaving otherwise in the lamp than in the sun. These divergencies do not coincide with the divergencies between the various sun tests cited above, and are evidently due to other causes, among which might be mentioned: (1) Spectral distribution; (2) intensity of light; (3) temperature; (4) humidity; (5) gases emitted by the lamp or produced by the action of the short wave lengths on the air. While the violet carbon arc doubtless has its uses as a rapid and convenient fading agency, it is not a reliable substitute for the sun, in our judgment.

Your Committee has also continued its work with the incandescent lamp as a source of light. These experiments are not yet completed, but will be described in detail by William D. Appel, of the Bureau of Standards, who has conducted not only all the trials with this type of lamp but also the greater portion of the sun tests. We desire to express our appreciation of Mr. Appel's valuable services at this time.

We plan in the near future to make a study of all dyes which have been proposed at one time or another as suitable standards for sun tests, with the object of selecting the very best obtainable ones. Suggestions along this line will be gratefully received. We also have in mind a comprehensive series of sun and lamp tests, which will ultimately include all the available dyes, in order to determine and record their relative fastness to light when exposed according to a common method.

Your Committee hopes that there may be a frank discussion of the various matters dealt with in this report, and particularly of the proposals for standardizing sun tests. All of the exposures referred to are on exhibition at this meeting, and may be examined by those interested, whose suggestions and criticisms are respectfully invited.

Discussion of Report of Sub-Committee on Light Fastness

President Olney—I think you will all agree with me that up to the present time the work of this Committee represents the most extensive and comprehensive research work in regard to fastness to light that has been undertaken. At least, as I have looked over the literature, I have been so impressed.

As Mr. Cady suggests, the Committee would like as much discussion as possible of a constructive nature, and also a critical nature. We are ready for discussion of this report.

R. L. Chase—This is a subject in which I have been interested for over thirty years. Some thirty years ago, when the direct dyes first began to come out, there were a large quantity all at one time, and it was quite a question as to how fast they were, compared with the dyes we had been using.

I took it into my head at that time to get some kind of comparative result in regard to fastness to light and also to soaping. I started in with a swatch of cloth, some several yards, dyed with a direct blue. It had a moderate degree of fastness.

I put up 144 samples at a time, and had two exposures. I had a little pasteboard, such that I could turn it up after its first exposure and then turn it a second time to get the second exposure.

My experience was somewhat different from Mr. Cady's in that in the winter, although my light was inside of a window and exposed to the South, I sometimes found it took twice as long to fade as it did in the summer. However, I will say that that was in a town (North Adams) where the sun went down at about 3.20 in the afternoon, which is quite different from a flat country where you have more sunlight. That may possibly have made the difference.

I have kept up that testing ever since, and I have books showing practically all the direct dyes exposed under that system.

At that time there was no co-operation among those who were making such tests; each one worked out their own plan. While that was helpful, of course, the present plan of getting something that you can compare at any time is such better, and I want to congratulate the Committee on the work they have done and the interesting report they have made. (Applause.)

President Olney—Is there any further discussion?

Dr. E. H. Killheffer—I wonder if it wouldn't be interesting to the general membership to know something of the action we took in the Council yesterday in respect to the systematic following of this work during next summer.

President Olney—Yes.

In my report, I made the comment that certain appropriations were made. One is for the amount of $600, if necessary, to provide one or more young men next summer to assist in a systematic series of exposure tests which will cover as far as possible the whole field of dyes. I think you will see that in this way a great help will be rendered to the Committee, and the results should be very valuable indeed in finally establishing our method of procedure.

Are there any further remarks with regard to this particular subject? If not, we will have the report of the Treasurer, Mr. Durfee having arrived.

Treasurer's Report
For the Year 1925

The Treasurer's report for the year 1925 is as follows:

Receipts

Dues	$4,765.43
Corporate Memberships	550.00
Research Fund	1,419.00
Year Book	177.00
Howes Pub. Co. (Refund)	60.50
Journals	71.75
Emblems	60.10
Interest from Bank	43.80
	$7,147.58

Expenses

Administration	$1,489.53
Journals	2,146.26
Sections	478.35
	$4,114.14

Total Receipts	$7,147.58
Total Expenses	4,114.14
Balance	$3,033.44
Cash on hand November 11, 1924	$1,268.84
Cash on hand November 9, 1925	$4,302.28

President Olney—You have heard that report. Are there any questions you would like to ask, or any corrections you would like to make with regard to it? If not, without taking up any more time, the report will be accepted and placed on file.

As to reports of other sub-committees, I do not know just which ones are intending to report at this time. The chairman of some of the sub-committees are not present. Are there any other sub-committees who have reports to present? If they have, we will hear from them at this time.

Dr. Scott on Standard Tests for Fastness to Washing

Dr. W. M. Scott—Mr. President, I don't know that this could be classified exactly under reports of sub-committees, but I think it might be a good idea to tell some of the plans that we have in mind with respect to furthering our fastness toward washing requirements; that is, determination of standard tests for fastness to washing.

As you know, the various sub-committees have presented a rather extensive report, which has appeared in our Year Book each year with some revisions, and in the 1925 Year Book you have the reports printed as they are up to date. But in order to obtain a better idea as to the value of the tests which we have suggested and also to really begin to get the co-operation of other associations besides our own in this matter of accepting standard tests for fastness toward washing, the Sub-Committees on Wool, Silk, and Cotton, with the assistance of Mr. Appel, of the Bureau of Standards, have decided to send out standard dyeings of various types of dyestuffs on these three fibers which will include all of the scale of fastnesses, from the most fugitive dyes to the fastest dyes, and have samples of these fabrics, dyed in this manner, sent to a number of agencies who are interested in this sort of work; such as the Laundryowners' National Association, some of the soap manufacturers, the large dyestuff manufacturers, some of the larger textile mills, and laboratories connected with some of the magazines, such as "Good Housekeeping," or any agency which is particularly interested in the fastness to washing of dyed fabrics.

The idea we have in mind is to get the reaction of these various laboratories and operators upon the value of the tests which we recommend, and the possibility of various operators in different places arriving at the

same conclusions with respect to the fastness of a color.

I think one of the chief difficulties so far has been that the methods described for determining fastness haven't been precise enough so that the operators working in different laboratories could really agree as to which class the various dyestuffs or dyed shades would fall into.

In that connection, I want to call to your attention some of the tests which have already been recommended by the various bodies who have worked upon this subject, and point out to you where, in my mind at least, there is something lacking. As you know, the German Fastness Commission went into this subject in quite a little detail, and as far back as 1914 they published a series of standards and tests for fastness toward washing. This was with respect to cotton and wool.

Their tests call for an immersion in soap, or a soap and soda solution, at two different temperatures. Test A for cotton is two-tenths per cent Marseilles soap, one-half hour, at 105 deg. Fahr. Test B is a half per cent soap and three-tenths per cent soda ash, one-half hour, at a boil.

Test A for wool is similar—that is, one per cent soap and five-hundredths per cent soda ash, fifteen minutes, 105 deg.; and Test B is with the same solution, fifteen minutes at 175 deg. Fahr.

Later the British put out a number of standard tests, based more or less upon these original German tests. In fact, the method of testing is practically the same. The British Research Association recommended for Test A on wool one per cent soap and five-hundredths per cent soda ash, fifteen minutes, at 104, and their Test B is the same solution fifteen minutes, at 176.

Then, just recently, the British Silk Association published a series of tests in which their first test is five-tenths per cent soap, one hour, at 104 deg. Fahr., and then the same solution one hour at 176 deg. Fahr.

When these various commissions come to grade their classes on the basis of these tests, it seems to me that they are entirely too ambiguous. That is, it is hard for anybody in endeavoring to follow out these tests to arrive at a definite conclusion. I just want to bring to your attention the classifications in some instances to illustrate this point.

For instance, the German Fastness Commission classification for cotton: Class No. 1, when treated as in Test A, the color becomes only slightly weaker, while cotton is stained. Class 2, when treated as in A, the dyeing is unchanged; cotton is not stained, or only to a very slight extent. Class 3, treatment as under B results in a distinctly weaker dyeing; cotton is only slightly stained. Class No. 4, treated as in B, the dyeing is unaltered and white cotton is only faintly colored. Class No. 5, treated as under B, the dyeing remains unaltered and white cotton is not stained, or only to a very slight extent.

Then we come to their classifications for wool. Class No. 1, treatment according to Test A, gives a marked change in the dyeing and heavy bleeding into the white. Class No. 3, treated as in A, there is very slight change, or no change in the dyeing, and no bleeding into the white. Class No. 5, treated according to B, there is no change or only a trace of change in shade, and no bleeding into the white.

Then we come to the British classifications. I must pass over this rather hurriedly, but will give you one instance; i. e., the British Silk Research Association classification for silk. Class 1, little or no loss of color at 176 deg. Fahr., and no staining. Class No. 2, little or no loss of color at 104 deg. Fahr.; no staining. Class No. 3, some loss of color at 104 deg. Fahr., and some staining. Class No. 4, much loss of color at 104 deg. Fahr. and much staining.

I will leave it to those of you who as textile chemists have worked in laboratories and have had experience in this sort of thing, as to whether it is possible to obtain an agreement between different operators in distinguishing between little loss of color, some loss of color, or much loss of color. That is, it seems to me that the terms are entirely too vague.

When we came to recommend certain tests for fastness to washing on silk, we felt that we should have a test for each classification. In other words, it is fairly easy when you are making tests to make three or four tests instead of just two; and if you have tests of varying degrees of fastness, and have each individual class based on a corresponding test, there is much more chance of agreement, it seems to me.

You have probably all read the report of the Sub-Committee on Silk in the Year Book, but just to bring it to your attention again, our Test No. 1 is one per cent soap, ten minutes at a boil; Test No. 2 is one per cent soap, ten minutes, at 160 deg. Fahr.; Test No. 3, one per cent soap, ten minutes, at 120 deg. Fahr.; and Test No. 4, one per cent soap, ten minutes, at 85 deg. Fahr.

In classifying according to these tests we simply group them in this manner:

Our Class No. 1—No appreciable alteration in color after Test No. 1.

Our Class No. 2—No appreciable alteration in color after Test No. 2, but an appreciable alteration after Test No. 1.

Our Class No. 3—No appreciable alteration in color after Test No. 3.

Our Class No. 4—No appreciable alteration in color after Test No. 4.

Our Class No. 5, the lowest class, is the one which would not even stand Test No. 4.

I want to bring to your attention the fact that this is a somewhat new departure that we have made, and to my mind it is the best plan to work on; that is, to have sufficient tests so that each classification is based upon a definite test. The various tests may be based upon changes in temperature, as we base the silk tests, or they may be based upon time changes—for instance, you might keep your temperature constant and have your first test in a very long immersion, another one in a shorter immersion, and so on down. In either case we avoid such terms as "much loss of color," "little loss of color," or similar phrases which are used to describe this loss in color.

I would be very glad to have some discussion on this idea, or if the members have other ideas on this subject I would be glad to hear them.

Discussion of Fastness-to-Washing Standards

President Olney—Are there any remarks with regard to Dr. Scott's report?

Dr. Robert E. Rose—Mr. Chairman, I am not quite certain whether I get the point, but as I understood it, in the British and the German methods of defining these changes which we all admit are very difficult to define, they have relied on using a specific color which you can use as a standard, and that acts as the definition. If you do that, I don't see that there is any ambiguity, and therefore you get around the difficulty that Dr. Scott complains of, I think, to a very large extent.

There is another point I would like to make, in connection with the suggestion that we make a number of tests and refine the tests to a point that we can put the dyestuff in on the scale. Practically, we have our hands full in doing all the testing we have to do now. If you increase the complexity of that test, you will find a great many people won't do it. It may be desirable, but they simply will not do it.

I know when I went back to the man in my laboratory who is responsible for these things and told him about this, he said, "How on earth are we going to get through all this work if we have to make so many wash tests?"

I bring that to Dr. Scott's attention as the opinion of a man who has made a great many such tests.

Dr. Scott—I would like to say, in connection with Dr. Rose's remarks, that it is perfectly true that the German Fastness Commission and the British have assigned standard colors as representatives of the groups which they propose. The only objection I have to that is that a good many of the laboratories and the people to whom we would like to recommend these tests do not have access to such standard colors, or it is not possible for them to make the standard dyeings in accordance with the exact specifications which the Fastness Commission recommends. In reality, the classification of your dyestuff in that case depends entirely upon the accuracy with which you prepare the dyeing of the standard color to which your unknown, so to speak, is to be referred. We have also listed certain standard colors as representative of each class of fastness, which may be used for comparison by such laboratories as have these dyestuffs available. We believe, however, that it is possible in the great majority of cases to obtain agreement in classification between different operators without the use of these standards.

Winthrop C. Durfee—I would like to ask Dr. Scott one question on that. We are dealing now with individual colors, as I understand it, in the fastness test.

Dr. Scott—These fastness tests are proposed to apply not only to dyestuffs as dyed on the fiber, but to dyed fabrics. That is, these tests on silk are supposed to be broad enough so as to be able to classify not only dyestuffs as dyed upon a fiber, but also to classify dyed fabrics of mixed colors.

Mr. Durfee—It is simply a question of optics that has arisen in my mind.

Given a red, yellow and blue dyed individually at reasonably full strength, all of which would come within Class 1, there would be a negligible drop or variation in shade, so that we could say they still belonged to Class Number 1. Let us dye an olive drab with those three colors, red, yellow and blue, or a brown. Each one—red, yellow, blue—vary very slightly from normality. However, the combined variation of the three components may alter the olive drab materially. Each of the three individual colors would be entirely free from criticism, that is, they would change very little within themselves, but it would make a radical difference in the final shade. The question is where would you class the olive drab?

Dr. Scott—I think the answer to that is that while the individual colors would naturally be classed in the group to which they belonged, if the olive drab changed its shade, as you suggested, it certainly should be classed much lower. That is, it is not in a class with the individual colors in respect to fastness toward washing, and the public or the person who was going to wash that olive drab wouldn't care whether the individual colors were rated way up high; they would simply be interested in the fastness of the shade that was produced.

Dr. E. H. Killheffer—Isn't that the value of the proposed system: that it will be equally applicable to the person concerned with dyes, to buyers in a department store, if you please, or to the Laundryowners' Association, in testing dyed fabrics, no matter what they are dyed with?

Dr. Scott—That was my idea.

President Olney—I should like to ask Dr. Rose one

question: Would it not be possible to select from these tests the particular portions that would be the most useful for your purpose, thus simplifying the test, and still having it conform to the standard method? I don't know whether I have made myself clear.

Dr. Rose—Yes. I think I would answer Professor Olney's question in the affirmative: that it is an advantage, and we could pick out what we want, provided we are not called upon to do all the tests simply because they are there.

William D. Appel—Mr. President, with regard to the number of tests which have to be made, I believe that any one who is familiar with dyes, or a dye manufacturer, would not have to go through the whole series of tests, if he had some idea generally as to whether the material was reasonably fast, or not. In one case you are only testing the higher class or two. You only have to make two tests probably. In the other case, you probably have to make the two lower tests. It won't involve an enormous amount of work, except for the comprehensive report on the colors that are totally unknown to start with.

President Olney—I don't want to check this discussion, but we will not complete our program unless we proceed a little more rapidly. Should there be time later, we will come back to these various interesting subjects.

I wonder if Mr. Livermore has anything to report for his committee.

W. D. Livermore—No.

President Olney—Mr. Christison, have you anything to say for your committee? Mr. Christison is chairman of the Sub-Committee on Fastness to Perspiration.

Report of Sub-Committee on Fastness to Perspiration

Submitted by Sub-Committee Chairman Hugh Christison

The salt tests have been made in several laboratories and the principal criticism is that we haven't had good results in getting check tests. We have endeavored to devise a system whereby the samples would dry out in a uniform time, and Professor Bertolet found that when he tried the scheme as it was outlined, the samples never dried; they even went so far as to mildew. We have made some investigation on that and find that we will have to define the weight of the material that we use and the surface and amount of sulphuric acid that we use for drying. After we make some more experiments along that line, we will be able to give a little more comprehensive report.

There is one difficulty we have and that is in testing very thin materials, like silks that are very light in weight, and overcoatings, which are the other extreme. We also would like to have any criticism that we can have from the members.

Our proposed tests and those of the English Commission are somewhat similar. They use salt, but they allow the salt solution to evaporate spontaneously, and that is the one thing we try to avoid, because spontaneous drying takes place much more rapidly in some seasons of the year than in others.

W. D. Livermore—Mr. President, I don't think it was quite fair to my committee for me to say that we had nothing to report, because the work that we did was largely in connection with the correlation of washing tests which has already been quite fully presented before this meeting.

On another point that has already been discussed somewhat, I think that it may become very important to make a distinction in our fastness tests between those that are necessary for a scientific determination of a result and those that are to be used for ordinary practice. For instance, I think that such phrases as occur sometimes in this German or English report (referring to English translation of report of German Commission), wouldn't go very well before a court. That is to say, I think they would be much too vague. On the other hand, I think that the extreme care which is evidently being used by the Committee on Light in regard to a very great amount of minutiae is very important in a scientific report and will be very valuable for future use. Yet most of us when we come to make our light tests will take some short cuts.

President Olney—In connection with the report made by Mr. Christison, I think he will agree that one of the difficulties in establishing satisfactory tests for fastness to perspiration is a lack of knowledge as to just what the constitution of perspiration is chemically. At the present time I believe a research is being conducted under the direction of Professor Johnson of Yale University, with the hope of securing more specific information in regard to that particular substance.

Are there any other reports of sub-committees? If not, we will pass directly to the next portion of the program. I would like to say that under this heading, "Contributions of Work Conducted Under the Auspices of the Research Committee," we are presenting at this time something which is rather new along the line of endeavors of this particular committee. Rather modest grants were made to these two members of our Association in order to carry on this work, and these are reports of what has been done so far.

In regard to Number 1 "Action of Alkalies on Wool, Importance of pH," I am very sorry, indeed, to announce that Dr. Chapin's mother died earlier in the week and the funeral is to take place this afternoon. Therefore, of course, he cannot be here. I am sure we all extend to him our sympathy and our regret that he is not able to deliver the paper in person. Mr. Durfee, however, whom many of you know is Dr. Chapin's father-in-law, has kindly consented to present the paper. Of course, he will be

unable to answer the fine points in the discussion, but we wish to have the paper presented, and Dr. Chapin wishes it, although of course he is very sorry indeed not to be able to be here to answer the various questions that will undoubtedly arise.

Mr. Durfee!

Winthrop C. Durfee—I want to say to the practical woolen men that there is much in this paper by Dr. Chapin that they are entirely familiar with as a matter of practice, but that Dr. Chapin selected caustic soda as a basis for his study because caustic soda represents the ultimate product of carbonate of soda when used in washing wool at high temperatures, and the use of carbonate of soda at normal temperatures simply gives an index of the causes that produce troubles on the wool fiber when improperly used.

The value, as I read it, and I am not expert on pH value, is that the methods of determining the pH value of solutions are accurate, and after experience has taught us exactly what is needed, the methods of measurement of pH value offer a definite guide to determine when the solutions are in proper condition for proceeding with the work. Therefore, as I understand it, it is a method by which one can drive himself on the safe side of solutions used in dyeing wood or in other processes in the manufacture of woolen goods, and be sure that he is not running into danger, and at the same time use the necessary chemicals to produce the results freely and properly.

Dr. Chapin's article is as follows:

Effect of Alkalies on Wool: Importance of pH

By H. C. Chapin

Last year, before the New England Section of this society, we described methods of measuring the activity of acid or alkali in a solution in distinction from the amount of free acid or alkali determined by ordinary methods of analysis. There followed discussion of possible applications to textile industry. At the next meeting of the Section, Dr. Scott described applications already made to silk degumming by Cheney Brothers. All this was published in the American Dyestuff Reporter, November 17, 1924, and March 9, 1925.

Essentially the principles involved are these: In its effect upon many materials the amount of free acid or alkali in a solution does not matter so much as the per cent of that free acid or alkali which is active. For example, concentrations of acetic and sulphuric acids equivalent in neutralizing power are by no means equivalent in their effect on a dye bath. Similarly, among alkalies a low concentration of ammonia may be harmless to wool, while caustic soda of same free alkalinity may ruin it.

Often the activity of acid or alkali may be modified by addition of some other substance said to act as a buffer. Sulphuric acid solution treated with sodium acetate assumes the milder properties of acetic acid. Dr. Scott reports that a caustic soda solution strong enough by itself to ruin silk may be so modified by addition of silk gum from a previous boil that it is just right for boiling off silk. Many a chemical used in a mill because in some mysterious way it gives practical results, really acts in the same way as a buffer, maintaining the activity of acid or alkali at a suitable degree, or pH as we call it.

This pH scale runs up to 14, with water neutrality at 7, acidities below 7 and alkalinities above 7. We now have methods of measuring pH directly. They are simple enough for use in a mill laboratory. They were described before the New England Section and in The Reporter last year.

In plans for research on wool our first object was to determine whether there exists a relation between weakening of wool by alkaline solutions and the pH; that is, the activity of the alkali measured electrically in these solutions. We believe that we have found such a relation; in fact, that the action of a solution on wool is more dependent upon pH—that is, the degree to which the alkali is active—than it is upon the actual free alkali concentration. Through kindness of Mr. Christison, of the Arlington Mills, we worked with naphtha extracted worsted yarn which had never been in contact with other alkali than that from the grease wool itself. After extracting with petroleum ether the small amount of oil emulsion left from spinning, we found this wool so light in color that we could see plainly the effect of subsequent alkaline treatment. The discoloration we found to be a function of pH rather than concentration of free alkali.

Our experiments were intended to prove in the simplest manner possible whether pH is a governing factor in the weakening and discoloring of wool. We did not duplicate actual scouring conditions, but the fundamental principle demonstrated is applicable to such conditions. Alkalinity is due in every case to the ability of a substance to liberate OH or hydroxyl ions, either directly or by reaction with water, HOH. For example, $Na_2CO_3 + HOH = NaHCO_3 = NaOH$. We therefore used sodium hydroxide as the simplest form in which to introduce these hydroxyl ions common to all alkali solutions.

To get accurate results at ordinary wool-scouring temperatures it would be necessary to have a bath maintained constantly at a definite elevated temperature for several hours. This we are going to secure. Meanwhile we have endeavored to demonstrate the principle and desirability of other more elaborate ex-

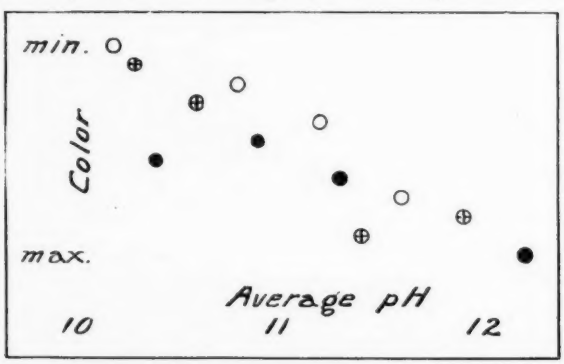
periments by preliminary work at room temperature of about 24 deg. Cent. or 5 deg. Fahr.

We made thirteen 3¼-gram skeins from the same 2-pound ball of two-ply No. 36 worsted yarn, twist 16 x 11. To secure uniformity we made each skein

Mols per Liter		pH		Color	Strength	
NaOH	$Na_2B_4O_7$	Initial	Final	change	dry	wet
0.	0			0	254	229
.04		12.3	12.1	12	227	166
● "	.0165	11.5	11.1	8	242	194
"	.0185	11.1	10.6	6	251	202
"	.0200	10.6	10.2	7	250	217
.02		12.0	11.8	10	242	181
⊕ "	.0068	11.6	11.2	11	242	203
"	.0090	10.9	10.3	4	244	208
"	.0100	10.4	10.1	2	257	221
.01		11.7	11.4	9	244	204
○ "	.0020	11.5	10.9	5	235	198
"	.0035	11.1	10.4	3	244	201
"	.0050	10.4	9.9	1	252	218

from five smaller skeins taken from different parts of the ball. These were extracted seven times with petroleum ether, dried, rinsed with water and wrung out, all in the same way. Each was then wrung out twice from one of a series of solutions of various known pH values and immersed in 450 c.c. of similar solution. The flasks containing these samples were left in a shaded place free from drafts for about forty-eight hours. All were then rinsed, soaked in running water for an hour, wrung out and dried. Thus all were subject to the same temperatures, light exposure, length of treatment and washing, so that we could ascribe differences in effect solely to differences in the solutions to be described.

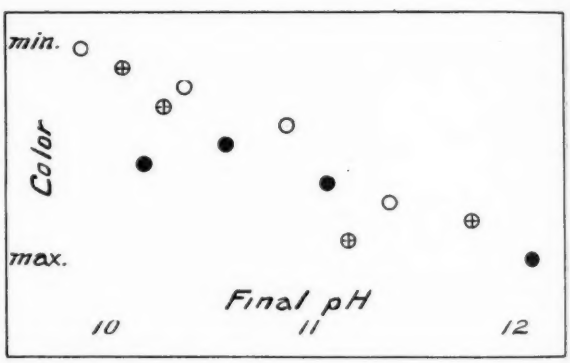
The first skein was treated with water alone. The next four were treated with 0.04 normal caustic soda solution, in one case alone, and the others with the same amount of caustic plus various amounts of borax. This borax raised the total alkalinity as measured by ordinary methods of analysis, but through buffer action lowered the active alkalinity measured in terms of pH. Then followed another series of four solutions with 0.02 normal caustic soda, first alone, then with increasing amounts of borax; finally a similar series with only 0.01 normal caustic, alone and with borax.



The dried skeins were graded according to color by three observers, judging independently and without reference to skein numbers or other data. Differences in judgment were small and were settled by opinion of the majority. The numbers under color change in the table begin with zero for the water-treated skein and increase with intensity of discoloration. They represent merely the order in which the skeins were graded, not intensity of the color itself.

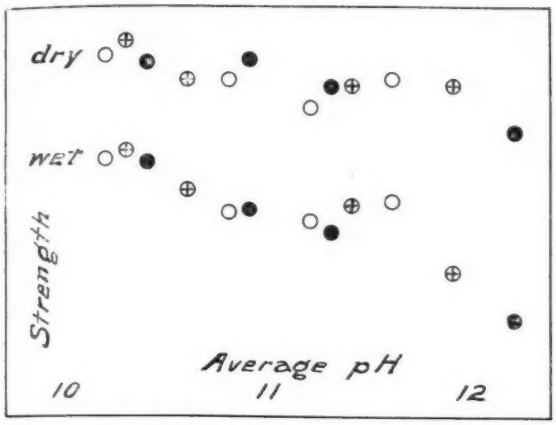
Thirty or more samples from each skein were broken in a strength-testing machine under prevailing atmospheric conditions, with such alternation of samples as to distribute effects of changes in humidity uniformly over all the skeins. The yarn was mounted between grips 50 cm. apart under initial tension of 50 grams and pulled at the rate of 1 foot per minute. Average breaking points in grams appear under "Strength dry" in the table.

We suspected that we were dealing with opposing effects of alkali; namely, weakening of wool fiber and



toughening of scaly fiber surfaces. The first would weaken the yarn. The second, through increased friction between fibers, might strengthen it, thus opposing and partially neutralizing the effect we desired to measure. We therefore made another series of tests upon samples dripping with water, hoping thus by water lubrication to avoid increasing friction and so more nearly measure the full weakening effect of alkali upon the fiber. The results appear under the heading "Strength wet."

Relations between these various numbers are shown more clearly when strength and color are plotted against pH. In the diagrams black-filled circles represent the four skeins treated with 0.04 normal caustic soda, alone and with various amounts of borax. Cir-



cles with crosses represent the 0.02 normal series, empty circles the 0.01 normal.

It seems logical to plot both color and strength against the average of initial and final pH, as we have done. The points fall more nearly in line if we plot color against final pH and strength against initial pH, so we show these also. The improvement in each case is interesting, but not great enough to prove that there is a reason back of it. The difference between initial and final pH is due to the buffer action of the wool itself.

It is obvious that amount of caustic soda does not alone determine the extent of discoloration or weakening, otherwise the black spots, representing skeins treated with most caustic, would all be at the bottom in each diagram, the crosses would be in the center, and the empty circles representing least caustic would be at the top. Actually lighter spots fall in many cases below darker, showing that lower concentrations of unbuffered or slightly buffered caustic affect both color and strength more than do higher concentrations of caustic with borax as buffer.

On the other hand, with a few exceptions the spots in each diagram fall fairly well in line, color increasing and strength decreasing as pH increases. Comparison of strengths dry and wet, plotted on the same diagram, shows dry higher and falling off less with increase in pH. While according to Shorter [J. S. D. & C., 41, 207; 1925] the difference in strength of wool dry and wet may be due to its colloidal structure, it suffices here to attribute the difference to the scaly surfaces of the fibers and the well-known roughening effect of alkali. Through friction between fibers this would strengthen the dry yarn and partially neutralize the weakening effect of alkali. In the wet yarn, lubricated with water, the fibers would slip more easily and show more nearly the full weakening effect of alkali, as seems the case according to the diagram.

It is apparent, then, that under the conditions studied pH is a better guide for predicting the probable effect of alkali on wool than is concentration of the alkali itself. It is likely that this is true under all conditions, although this needs confirmation by experiment at higher temperatures and with chemicals more commonly used in scouring and dyeing.

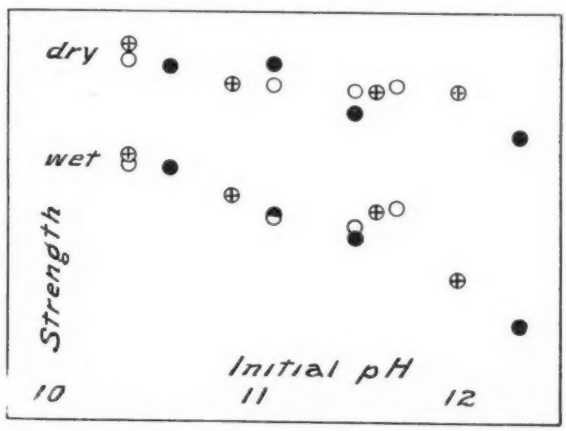
President Olney—I might say with regard to this particular paper and also Researches Numbers 2 and 3 that the facilities and apparatus for carrying on this work were furnished through the courtesy of the Lowell Textile School, and this institution will be pleased to offer its facilities for any future work of the Research Committee.

We are going to depart from our regular program at this point for two reasons. The paper which is to be presented by Dr. Scott is along this same line, and so I think it would be well to have it come next. In the second place, Dr. Scott is in rather a hurry to get away this morning, and this arrangement will facilitate matters for him. So, if Dr. Scott is ready we will hear from him now and postpone discussion of Dr. Chapin's paper until we have heard Dr. Scott's.

Dr. Walter M. Scott—The subject of my paper as listed on the program is simply "Hydrogen Ion Concentration." Those of you who have looked up anything about that subject know that to entirely cover the topic of "Hydrogen Ion Concentration" is a pretty big bill to fill. So for this particular paper I have modified the subject in this respect: I expect to talk on hydrogen ion concentration particularly with regard to its relation to problems of dyeing.

I might say that in the preparation of the material for this paper, I am very greatly indebted to two members of the laboratory of Cheney Brothers—Dr. E. M. Shelton and Miss Hazel F. Grover.

. . . Dr. Scott then presented his prepared paper:



Proceedings of the American Association of Textile Chemists and Colorists

Hydrogen Ion Concentration—Its Relation to Problems of Dyeing

By Walter M. Scott, Ph.D.

Assisted by Dr. E. M. Shelton and Miss Hazel F. Grover

Your President has asked me to make a few remarks on the subject of hydrogen ion concentration, particularly from the standpoint of its application to textile work. I am very glad to do this, because I feel that the American textile chemists and dyers, as well as manufacturers, do not fully appreciate the important bearing which this particular phase of chemistry has upon their everyday problems.

I am impressed by the fact that in connection with problems of dyeing, and textile chemistry in general, there has been much more work of a scientific nature done in England and on the Continent than in this country. This is a state of affairs which cannot last for any length of time without seriously handicapping our textile industry in their competition with the foreign manufacturers. Therefore it is distinctly up to the members of this Association not only to keep themselves informed of the progress which has been made but to contribute to further progress along similar lines.

In the present paper I am going to confine myself to the part which hydrogen ion concentration plays in the theory of dyeing. I will first review briefly some of the work which has already been published, and then describe a few of the experiments carried out in our laboratory which have a bearing on the same subject.

In the Journal of Physical Chemistry for 1922, Volume 26, page 384, W. W. Paddon showed that the removal of the amino groups from wool was without effect on its affinity for acid dyes. This apparently discredited the chemical theory of dyeing originally presented by Knecht in 1888, which assumes that basic dyes combine with the free carboxyl groups of wool or silk, and acid dyes with free amino groups.

The same observation was confirmed by E. R. Trotman in an address before the Midlands Section of the Society of Dyers and Colourists, reported in the March, 1924, issue of their journal, page 77. This investigator found that with acid colors such as Acid Magenta, Orange II, Fast Red A and Indigo Carmine, there was no difference in affinity for ordinary wool and deaminated wool. On the other hand, the deaminated wool had an increased affinity for basic colors such as Methylene Blue.

Another angle of this subject is presented by Briggs and Bull in the Journal of Physical Chemistry for 1922, Volume 26, page 845. They record an extended investigation which led them to the conclusion that "the taking up of dyes is a case of adsorption and that the amount of dye adsorbed varies continuously with a change in the hydrogen ion concentration of the dye bath."

The latest article which has come to my attention is found in the May, 1925, issue of the Journal of the Society of Dyers and Colourists, page 172. The author of this article, John B. Speakman, is a firm adherent to the chemical theory of dyeing, although admitting that this theory as originally formulated must be modified somewhat to take into account certain phenomena of colloidal adsorption and electrical ionization which have been noted by various observers.

Mr. Speakman classifies wool as an amphoteric colloid, based on the theory, pretty definitely established by Emil Fischer, that it is chemically a complex combination of amino acids. If we consider the simplest of these amino acids as an illustration—namely, glycl-glycine, whose formula is $NH_2—CH_2—CO—NH—CH_2—COOH$— we find that there is a free amino group, a free carboxyl group, and a —CO—NH— group. The higher polypeptides, such as wool and silk, will naturally contain a large number of these groups.

The —CO—NH— groups are capable of existing in two forms: keto form [—CO—NH—] and enol form [—C(OH) = N—]. The conversion from keto to enol form is reversible and is dependent on the hydrogen ion concentration of the solution in which the protein is immersed. In acid solutions the keto form predominates and will combine with the acids present, while in alkaline solutions combination occurs with the enol form. The reactivity of their —CO—NH— groups, in addition to the known activity of their free amino and carboxyl groups in acid and in alkaline solutions, leads to the designation of wool and silk as doubly amphoteric.

Irrespective of the truth or falsity of Mr. Speakman's theories, he demonstrates by careful experiments a number of facts which are of immediate interest. These are briefly as follows:

1. The percentage neutralization of a protein by acids or alkalies is dependent only on the hydrogen ion concentration of the solution, and not on the absolute amount of acid or alkali present.

2. Wool has an isoelectric point of approximately pH 4.8, at which point it is in combination with a minimum of acid or alkali.

3. In an acid dye bath, both color acid and inorganic acid are present, and the relative amounts of each which will enter into combination with the wool depend on the relative affinities and the relative concentrations of the two acids. Later observations lead us to believe that the dissociation constants of the respective acids play an important part in determining the amounts of each which will enter into combination with the protein.

4. The amount of dye absorbed from a solution of given initial concentration should be dependent only on the hydrogen ion concentration, and not on the particular inorganic acid employed, provided the affinities of the different inorganic acids are the same.

This last proposition is of decided practical interest to the dyer, and so it was decided to carry out a few experiments in the laboratory in order to demonstrate its truth or falsity. A number of dye baths were made up, consisting of 100 c.c. of sericin (silk gum) liquor and 100 c.c. of distilled water. These dye baths were standardized to varying hydrogen ion concentrations by the use of sulphuric acid, acetic acid, and hydrochloric acid respectively. In each bath sufficient Patent Blue V (Colour Index No. 712) was dissolved to equal 1 per cent of the weight of silk to be dyed. A standard 4-gram patch of pure silk crepe was used in each case. The dye baths were heated to a temperature of 190 deg. Fahr., the silk was then immersed and the bath kept at this temperature for half an hour. The patches were washed thoroughly in cold water, extracted, and dried in the usual manner.

A record was kept of the hydrogen ion concentration of the dye bath immediately before and after dyeing. Measurements were also made by the use of the colorimeter to determine the intensity of color in the dye bath before and after dyeing, thereby obtaining a comparative idea of the amount of color acid taken up by the silk. These results appear in Table No. 1.

TABLE No. 1

PATENT BLUE V (Colour Index No. 712)

Dye baths standardized with—

pH Before	pH After	Color Acid Removed
Sulphuric Acid		
3.19	3.28	.. per cent
4.38	4.30	22 per cent
5.11	4.81	2 per cent
6.80	5.70	0 per cent
Acetic Acid		
3.60	3.70	50 per cent
4.34	4.42	24 per cent
5.23	5.22	16 per cent
6.34	6.18	7 per cent
Hydrochloric Acid		
3.55	3.74	.. per cent
5.18	4.99	8 per cent

Similar experiments were conducted with Azo Fuchsine 6B (Colour Index No. 154). In this case an additional modification was tried. Two sets of dyeings were made; one set being kept in the dye bath for half an hour similar to the Patent Blue V, while the other set was immersed only ten minutes. The changes in hydrogen ion concentration and color strength of the various dye baths are shown in Table No. 2.

TABLE No. 2

AZO FUCHSINE 6B (Colour Index No. 154)

Dye baths standardized with—

pH Before	pH After 10 Mins.	pH After 30 Mins.	Col. Acid Removed (per cent) After 10 Mins.	Col. Acid Removed (per cent) After 30 Mins.
Sulphuric Acid				
3.2	3.25	3.36	35	33
4.4	4.26	4.38	18	15
5.5	4.91	..	4	..
7.4	6.41	6.10	0	0
Acetic Acid				
3.6	3.72	3.74	33	37
4.3	4.43	4.44	14	10
5.2	6.26	5.23	4	7
6.4	6.13	6.07	0	0
Hydrochloric Acid				
3.5	4.19	4.27	35	37
6.4	6.30	5.66	0	0

It will be noted that the changes in the hydrogen ion concentrations of the dye baths during the dyeing operations were slight in most cases. They seem, however, to conform to a certain general rule that when the original pH is low there is an upward tendency during dyeing; while if the original pH is high, particularly if it is over 5, there is a downward tendency. In other words, the hydrogen ion concentration of dye baths, with a high initial concentration, tend downward during dyeing, and vice versa.

The relation of the hydrogen ion concentration of the dye bath to the amount of color acid taken up by the silk is best shown graphically (see Fig. 1). The colorimeter readings on the solutions of Patent Blue were not very reliable because of changes in hue as well as strength, the solutions becoming gradually greener as the hydrogen ion concentration increased. Even with the solutions of Azo Fuchsine, slight variations in strength could not be detected. However, the readings were sufficiently accurate to demonstrate without question that the absorption of color acid increased as the hydrogen ion concentrations of the dye baths became greater. Also, and still more important, that the amount of color acid absorbed by the silk was practically the same at a given initial hydrogen ion concentration of the dye bath no matter whether the necessary acidity was obtained with acetic, sulphuric or hydrochloric acid.

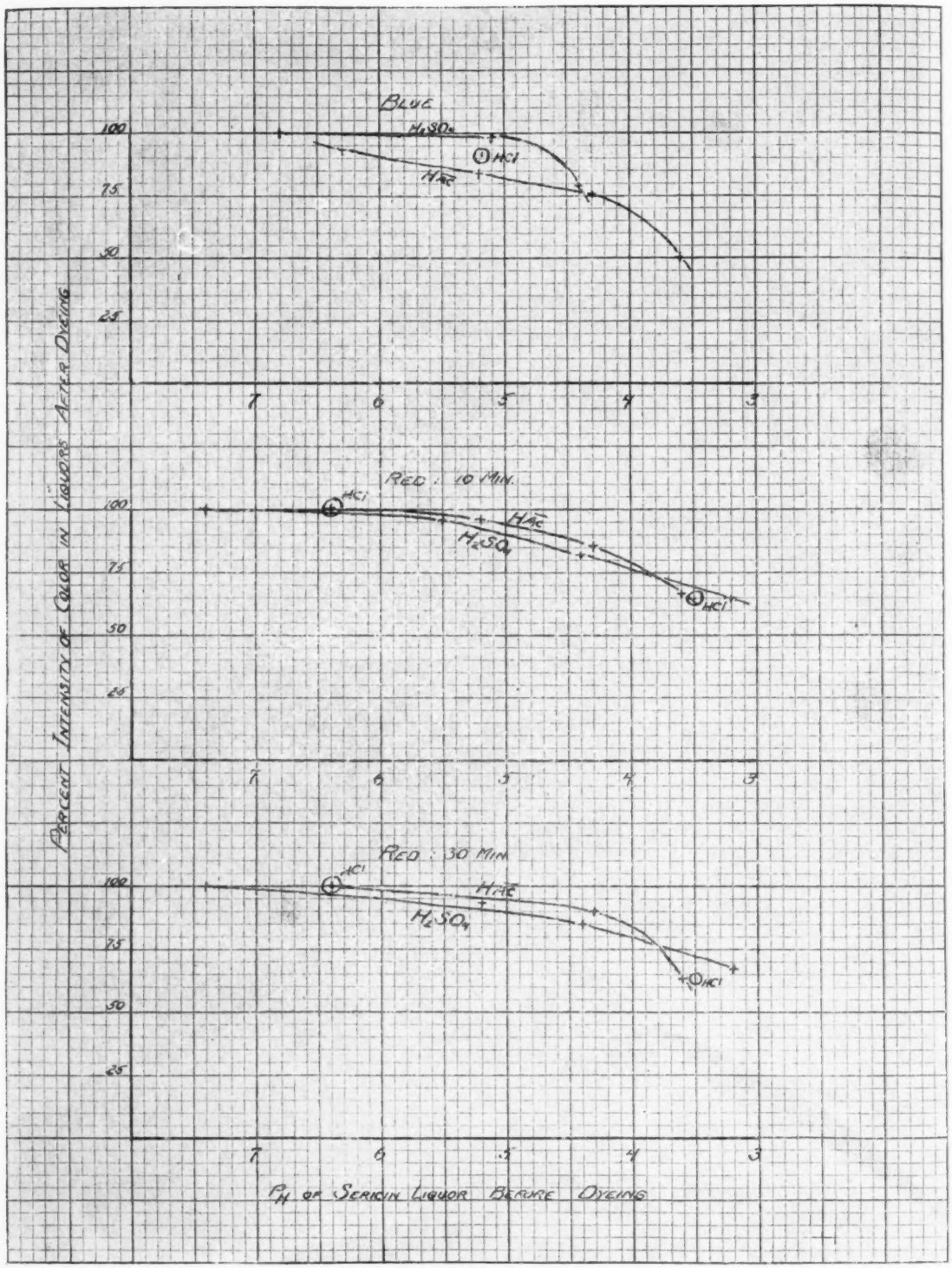

BLUE
H_2SO_4
HCl
HAc
100
75
50
25
7
6
5
4
3
RED : 10 MIN.
HCl
HAc
H_2SO_4
HCl
RED : 30 MIN.
HCl
HAc
H_2SO_4
HCl
PERCENT INTENSITY OF COLOR IN LIQUORS AFTER DYEING
PH OF SERICIN LIQUOR BEFORE DYEING

FIG. 1

I have mounted the thirty-minute blue and red samples on cards and it will be seen that they only confirm the conclusions drawn from the colorimeter readings. The dyeings made by a ten-minute immersion in the Azo Fuchsine dye baths were practically identical in strength with the thirty-minute dyeings, which indicated that the maximum amount of this dyestuff was absorbed within the first ten minutes. Unfortunately, the length of the immersion was not sufficient to level them up, so I did not attempt to mount them. I have here the three dyeings made with the highest hydrogen ion concentration of each acid, which are sufficient to illustrate my point.

In conclusion, then, we have demonstrated that the following theories of dyeing, formulated by Mr. Speakman, apply to silk as well as to wool:

1. The amount of acid dyestuff absorbed by the silk from a solution of given initial concentration increases with the hydrogen ion concentration of this solution.

2. In dye baths acidified with acetic, sulphuric or hydrochloric acid, the amount of acid dyestuff absorbed by the silk at a given initial hydrogen ion concentration of the solution is constant and is not dependent on the absolute amount of acid used to obtain this hydrogen ion concentration.

We realize that we have not fully covered the range of acids, particularly those with very low dissociation constants usually described as weak acids. We hope to continue with work along this line at a later date. However, there is no question but that the hydrogen ion concentration of the dye bath is a very important factor in the dyeing of silk, and must be given careful consideration in any attempt to establish standardized dyeing.

Discussion of Hydrogen Ion Concentration and Its Application to Dyeing

President Olney—I think you will all agree that this paper of Dr. Scott's is a valuable contribution to our fund of knowledge in regard to hydrogen ion concentration and its application in dyeing. We shall have to confine the discussion on these two papers to about five minutes.

Mr. Christison—I would like to ask Dr. Scott, if it isn't too personal, if he has been able to put the application of his results into practice by buying a much cheaper acid, sulphuric acid, to replace the acetic, simply by reducing the concentration of the sulphuric acid, making its weaker?

Dr. Scott—We haven't as yet done very much in a practical way to take advantage of this particular study that we are making, but judging by the results we obtained here, it would seem possible to use a cheap, strong acid combined with some buffer perhaps which would reduce the hydrogen ion concentration of that strong acid, and obtain equivalent dyeings to those obtained with a larger amount of acetic acid, which, of course, would be more costly.

President Olney—Are there any further remarks or questions?

Robert W. Jaeger, Jr.—I should like to ask Mr. Durfee what the action of the buffer is when the bowl is very dirty; say, when it contains four or five per cent of actual wool grease. What happens if the buffer then is added in constant amounts, as it was at the start?

Mr. Durfee—Inasmuch as grease and dirt in the bowls are identical with that which is on the wool, we would have no further action, with what is in the wool already, and therefore that factor would be negligible.

President Olney—Are there any further remarks?

Dr. Robert E. Rose—I would like to make one remark which may be entirely superfluous, but it seems to me it may be appropriate.

To those who are not familiar with the pH method of measuring acid and alkali values, it might seem possible that by using a strong acid in dilution you could cut the pH until you get the value of what we call a weakly dissociated acid. That is practically impossible. You would have to cut the strength of your sulphuric acid to the vanishing point in order to get the value of the acetic acid at any concentration.

That is merely a point of reference.

President Olney—We have just a minute more that we can devote to this discussion.

George A. Moran—Do you get the same concentration with acetic as you get with sulphuric?

Dr. Scott—The only way you can do that is by the use of some buffer with the sulphuric. You can't by any conceivable chance get the same hydrogen ion concentration with acetic as you can with straight sulphuric acid, as Dr. Rose has just pointed out, because with acetic acid solutions it is impossible to obtain a pH much below two no matter how concentrated the acid is. But if you add to a water solution just a very slight amount of sulphuric acid, you will carry the pH of the solution below two immediately. Of course, in our experiments we used the sericin liquor to act as a buffer. There are lots of other buffers among the inorganic salts. Even our well-known Glauber salt has a pronounced buffer action on sulphuric acid. By the use of buffers you can reduce the hydrogen ion concentration of the sulphuric, and thereby raise the pH of the solution.

President Olney—We will have to proceed to the next

paper, contribution No. 2 of the Research Committee by Arthur K. Johnson.

. . . Mr. Johnson presented the following paper:

Quantitative Studies of the Action of Alkalies (Caustic Soda) on Rayon Silks and of Their Relative Hygroscopic Properties

By A. K. Johnson

The general purpose behind these studies of the losses of rayon silks with caustic soda and of their relative hygroscopic properties as shown by moisture content and by regain was to evolve a satisfactory scheme for the quantitative analysis of rayon silk-wool union materials under laboratory conditions. The viewpoint maintained was, therefore, analytical rather than industrial.

With the growing importance of rayon silks both in consumption and in variety of uses, the demands for analysis and for satisfactory methods therefore become more frequent. Indeed, these tests at first were instigated especially by our own requirements for making such analyses and to substantiate our confidence in our results against indirectly suggested unreliability.

Inasmuch as the results obtained have proved of service to us and to a few other individual chemists doing similar work, we have been granted the privilege of presenting them for your consideration and discussion.

A—Quantitative Losses of Artificial Silks with Caustic Soda

The purpose here was to ascertain the actual losses and their uniformity upon treatment with caustic soda, in order (1) to determine the suitability of this reagent under proper conditions for making union fabric analyses and (2) to establish the factor to be applied to the weight of the residual fiber mass from the analysis to correct it for the loss from caustic action.

The first attempt was the carrying out with bleached commercial rayon skeins (Lustron, not bleached) of the usual cotton-wool union procedure. That is, boiling for fifteen minutes with 15 per cent caustic soda, washing thoroughly, rinsing in very dilute acetic acid, and washing acid-free with water. Final rinses in 95 per cent alcohol and in ether were given before bone-drying in a Freas electric conditioning oven at 110 deg. Cent. The results showed this solution to be too severe in its action even for viscose (see Table 1).

While the yarns of cellulose acetate and viscose could be readily handled, that of nitro (Tubize) silk was largely disintegrated, while washing, into short fragments. These, however, could be recovered by use of a 100-mesh brass sieve. The color or odor of the caustic solution in some cases was characteristic and, it may be, of qualitative analytical value.

A much more satisfactory result was obtained by using caustic soda solution of 5 per cent strength kept for fifteen minutes at 180 to 200 deg. Fahr. In this test, samples of yarn of 150 or 300 denier size and deoiled with petroleum ether were used. Except for the above conditions, the test was carried out identically as in the foregoing case.

The results of these determinations are tabulated below:

TABLE No. 1

Average Per Cent Loss of Rayon Yarns on Treatment with Petroleum Ether and with Caustic Soda. Results upon Bone-Dry Basis.

Nitro	
Number of samples	6
Approximate weights of samples, grams	2–3
Per cent loss with petroleum ether	0.48
Per cent loss with 5 per cent at 180-200 (deoiled)	8.41
NaOH for fifteen minutes:	
Deviation .....max., ÷0.87; min., —0.99	
Fifteen per cent at 212, oil corrected for	44
Viscose	
Number of samples	7
Approximate weights of samples, grams	6–10
Per cent loss with petroleum ether	0.20
Per cent loss with 5 per cent at 180-200 (deoiled)	2.26
NaOH for fifteen minutes:	
Deviation .....max., +0.33; min., —0.44	
Fifteen per cent at 212, oil corrected for	17
Cuprammonium	
Number of samples	6
Approximate weights of samples, grams	1–2
Per cent loss with petroleum ether	1.33
Per cent loss with 5 per cent at 180-200 (deoiled)	3.96
NaOH for fifteen minutes:	
Deviation .....max., +0.35; min., —0.42	
Fifteen minutes at 212, oil corrected for	23
Celanese	
Number of samples	7
Approximate weights of samples, grams	2
Per cent loss with petroleum ether	0.39
Per cent loss with 5 per cent at 180-200 (deoiled)	53.0
Lustron	
Number of samples	6
Approximate weights of samples, grams	7–8
Per cent loss with petroleum ether	0.11
Per cent loss with 5 per cent at 180-200 (deoiled)	64.0

The petroleum ether losses were performed to satisfy curiosity.

The Celanese and Lustron were included here for curiosity's sake also. The yarns were largely reduced to a

(*Continued on page 875*)

QUANTITATIVE STUDIES OF THE ACTION OF ALKALIES ON RAYON SILKS

(*Continued from page 866*)

slimy mass and were not readily handled. The extremely high losses in weight speak for themselves as to the severe action of the caustic soda.

The regenerated celluloses under this treatment show a residue which is easily handled in a quantitative way, and the losses are not unduly large. These losses, which are suggested as correction factors, are not far removed from the usual factor for cotton—namely, 5 per cent. Viscose silk, the one of by far the most importance in number of occurrences and in amount, shows only 2.26 per cent loss based on bone-dry weights. This value has been very closely checked by an entirely independent observer. Cuprammonium with 3.96 per cent is not far removed. Moreover, the variations of both from the average are very nominal. The nitro variety shows a larger loss and larger variations from the average than the other, but still appears to be within the range of reasonable accuracy.

The activity of the caustic soda solution for wool at 5 per cent strength and 180 to 200 deg. Fahr. was proved when 15 grams of woolen yarn dissolved with stirring in three to five minutes. Raw silk and Tussah silk did not dissolve completely in the five minutes.

The experience of these tests would seem to indicate that the viscose silk-wool mixture so common to-day may be accurately analyzed by caustic soda under the conditions of 5 per cent strength (or less) and a temperature of 180 to 200 deg. Fahr. Further, that were nitro silks (Tubize) or cuprammonium met with in wool unions, they also could be accurately determined by the same method.

I would like to suggest these values as tentative factors for correction: Viscose, 2.26 per cent; cuprammonium, 3.96 per cent; nitro, 8.41 per cent—on the bone-dry basis.

B—Studies on the Relative Hygroscopic Properties of Rayon Silks

Interest in the relative hygroscopic properties of artificial silks and in their normal moisture contents in the laboratory (temperature approximately 70 to 80 deg. Fahr.; humidity normally approximately 15 per cent) led to this reasonably quantitative study of their comparative behavior on exposure to industrially controlled humidities and to the laboratory atmosphere. Interest was also centered upon their reabsorption powers after bone-drying and re-exposing in the laboratory atmosphere.

The artificial silks used were all first-quality yarns of commerce and came for the most part from several different lots of varying ages. All but the Lustron rayons were bleached yarns. The varieties tested were:

1. Nitro (Tubize), about 150-denier size.
2. Viscose, a heavy plied yarn (300).
3. Cuprammonium, about 120-denier.
4. Lustron, a heavy plied yarn (300).
5. Celanese, about 150-denier.

These tests were carried out under three different humidity conditions where humidity was measured by a sling psychrometer. One lot was done under the winter atmosphere of the laboratory—i. e., steam-heated and a very drying air (about 15 per cent humidity). These yarns were petroleum-ether-extracted for oil. The reabsorption test on this group was made by exposing the bone-dried yarns in the laboratory twelve to fifteen hours (over night) at 15 per cent. During the last half hour the moisture content of the room, unfortunately, increased to 22 per cent and very likely affected the two samples CA and L somewhat.

A second group was run in a special room with humidity controlled by an industrial humidifying system, humidities varying in the cycle of operation of the humidifying machine from about 68 to 61 per cent at 70 deg. Fahr. Yarns were not deoiled.

The third set were in the same room nine months later, with humidities ranging in the cycle of operation from 78 to 61 per cent. The cycle occupied eleven minutes, during one minute of which the moisture was continuously admitted. Yarns were not deoiled. The results tabulated below were computed from the respective weights, as indicated:

1. Per cent loss with petroleum ether $= \dfrac{\text{loss} \times 100}{\text{original air-dried weight sample}}$

2. Per cent loss on bone drying (moisture) $= \dfrac{\text{loss} \times 100}{\text{air-dried weight sample}}$

3. Per cent regain $= \dfrac{\text{loss} \times 100}{\text{bone-dry weight sample}}$

4. Per cent reabsorption on exposure to air $= \dfrac{\text{gain} \times 100}{\text{bone-dry weight sample}}$

The table below contains the average figures for each group (A = steam-heated laboratory conditions, approximately 15 per cent humidity and about 75 deg. Fahr. tem-

perature; B = 68 to 61 per cent humidity at 70 deg. Fahr.; C= 76 to 61 per cent humidity at 72 deg. Fahr.):

TABLE No. 2

Average Results of Tests Upon Moisture and Regain of Rayon Silks at 15% (A), 68 to 61% (B), and 76 to 61% (C), Relative Humidities

GROUP A

Nitro (150-*Denier*)

Number of samples	6
Weight of samples	2–3
Average per cent moisture	6.37
Average per cent regain	6.79
Regain deviations from aver.: max., +0.19; min., —0.21	
Per cent moisture reabsorbed at humidity	3.95 at 15%

Viscose (300-*Denier*)

Number of samples	7
Weight of samples	6–10
Average per cent moisture	6.18
Average per cent regain	6.60
Regain deviations from aver.: max., +0.06; min., —0.16	
Per cent moisture reabsorbed at humidity	4.78 at 16%

Cuprammonium (150-*Denier*)

Number of samples	6
Weight of samples	1–2
Average per cent moisture	6.63
Average per cent regain	7.18
Regain deviations from aver.: max., +0.22; min., —0.17	
Per cent moisture reabsorbed at humidity	5.95 at *22%

Celanese (150-*Denier*)

Number of samples	6
Weight of samples	2
Average per cent moisture	1.89
Average per cent regain	1.91
Regain deviations from aver.: max., +0.30; min., —0.07	
Per cent moisture reabsorbed at humidity	1.51 at 16%

Lustron (300-*Denier*)

Number of samples	7
Weight of samples	7.8
Average per cent moisture	2.10
Average per cent regain	2.15
Regain deviations from aver.: max., +0.17; min., —0.12	
Per cent moisture reabsorbed at humidity	1.10 at *22%

GROUP B

Nitro (150-*Denier*)

Number of samples	5
Weight of samples	1–2
Average per cent moisture	13.4
Average per cent regain	15.4
Regain deviations from aver.: max., +1.5; min., —0.9	

Viscose (300-*Denier*)

Number of samples	5
Weight of samples	2–5
Average per cent moisture	12.6
Average per cent regain	14.4
Regain deviations from aver.: max., +1.0; min., —0.5	

Cuprammonium (150-*Denier*)

Number of samples	7
Weight of samples	1–5
Average per cent moisture	12.7
Average per cent regain	14.6
Regain deviations from aver.: max., +1.1; min., —0.7	

Celanese (150-*Denier*)

Number of samples	6
Weight of samples	2–7
Average per cent moisture	6.42
Average per cent regain	6.87
Regain deviations from aver.: max., +0.17; min., —0.12	

Lustron (300-*Denier*)

Number of samples	5
Weight of samples	9–10
Average per cent moisture	5.18
Average per cent regain	5.49
Regain deviations from aver.: max., +0.25; min., —0.64	

GROUP C

Nitro (150-*Denier*)

Number of samples	7
Weight of samples	1–2
Average per cent moisture	14.2
Average per cent regain	16.6
Regain deviations from aver.: max., +1.1; min., —1.3	

Viscose (300-*Denier*)

Number of samples	6
Weight of samples	2
Average per cent moisture	13.4
Average per cent regain	15.5
Regain deviations from aver.: max., +0.3; min., —0.2	

Cuprammonium (150-*Denier*)

Number of samples	7
Weight of samples	1
Average per cent moisture	13.8
Average per cent regain	16.0
Regain deviations from aver.: max., +1.5; min., —1.5	

Celanese (150-*Denier*)

Number of samples	6
Weight of samples	2–3
Average per cent moisture	7.19

*22 per cent a short time.

Average per cent regain	7.74
Regain deviations from aver.: max., +0.19; min., —0.18	

Lustron (300-Denier)

Number of samples	8
Weight of samples	4
Average per cent moisture	6.19
Average per cent regain	6.61
Regain deviations from aver.: max., +0.64; min., —0.32	

Mercerized Cotton

Number of samples	6
Weight of samples	4–7
Average per cent moisture	7.62
Average per cent regain	8.24
Regain deviations from aver.: max., +0.29; min., —0.10	

In comparing the values, one of the immediately outstanding features is the marked difference in the values for moisture and regain between the regenerated cellulose group (nitro, viscose and cuprammonium) and the cellulox derivative group (acetate silks). If in each test, A, B and C, we average the regain values for the regenerated cellulose group and also those of the acetate silks, and then divide the former average by the latter, the difference between the hygroscopic natures may be pointedly expressed in the following ratios, at 15 per cent humidity: 1:3.28, i. e. 6.86 ÷ 2.03; at 68 to 61 per cent, 1:2.39, i. e. 11.8 ÷ 6.18, and at 76 to 61 per cent, 1:2.23, i. e. 16.03 ÷ 7.18.

Comparing the groups of C with mercerized cotton, the average regain of the regenerated cellulose is 1.94 = 16.03 ÷ 8.24, while the acetate silks are 0.87, or 1.18 ÷ 8.24. While no cotton samples were run at the lower values, experience from independent tests made under conditions similar to A in the laboratory would tend to suggest that cotton yarn was a little more intermediate between the two groups at the 15 per cent humidity. This would imply a somewhat greater tendency to lose moisture at the lower humidities on the part of acetate silks than either cotton or the regenerated celluloses.

Going to a comparison of the individual members of the cellulose acetate group, Celanese appears to be the more hygroscopic in the ratio of 1.17—1 in tests B and C. In test A the ratio changes to 0.89—1 in favor of Lustron. Celanese shows less variation than Lustron, and may be quicker on reabsorption (not lose its power of reabsorption to such an extent on bone-drying).

The regenerated cellulose group figures illustrate the superior regain and moisture sensitivity of nitro silks. Cuprammonium runs second. These two have also more variability than viscose. At the 15 per cent figure cuprammonium seems to retain more of its moisture than nitro or viscose.

The apparent order of descending hygroscopic nature of the artificial silks at reasonable humidities may be stated as nitro, cuprammonium, viscose, Celanese and Lustron. If the values for each in the tests B and C are averaged together, the respective numerical expressions of regain become 16, 15.3, 14.05, 7.31, 6.05.

Discussion

President Olney—We can devote five or six minutes to a discussion of this paper.

William F. Deady—I would like to ask Mr. Johnson if the continuous boiling in the kier for eight or ten hours will have any greater effect in reducing the weight.

Mr. Johnson—I should imagine it might, although I haven't any information on that at hand. I should imagine that the longer the material was treated the greater would be the loss, although it might not be in direct ratio. It might be a decreasing ratio. I haven't any information at hand to state that definitely.

Dr. Joseph F. X. Harold—I would like to ask Mr. Johnson if any tests were made on the nitro silk as to the completeness of the removal of nitro bodies.

Mr. Johnson—No.

Dr. Harold—That might well explain the high losses with caustic, as it is generally known that nitro bodies are quite soluble in caustic.

With respect to that 5 per cent test with caustic soda, I would say that if 8 per cent had been used it would have been much more representative in the analysis of fibers, if you wanted the silk to disappear. The 8 per cent caustic soda, while not standard for the ordinary method of testing real silk, in the presence of cellulose is a very standard method in certain textile industries where there has to be a real solution of the silk away from the cotton.

For instance, in the embroidering industry a back of Bourette silk is used as a ground for the stitching of the embroidery threads, and thereafter removed by digestion in a caustic bath. In those cases it is quite the rule throughout the industry to use an 8 per cent bath, in which case there is a total removal of the silk, and it is rather urgent that it should be so, because the embroidery would be spoiled if the least bit of silk were left under the shower in the Bourette bath. The industry finds that an 8 per cent caustic is about the best concentration to leave the lace or the embroidery absolutely free from any undissolved silk fiber.

I would like to have you, if you would, in the future make some tests on that nitro silk, to make sure that there isn't any nitro body left, as shown by the diphenylamine reaction.

Mr. Johnson—You mean after the treatment with caustic soda?

Dr. Harold—No; before.

Mr. Johnson—I made that test, and it gave a diphenylamine reaction (blue color).

Dr. Harold—That was proof enough that there was nitro cotton left, because a truly regenerated cotton would fail to give diphenylamine tests. So your reactions with caustic soda are not the reactions of a completely regenerated cellulose, but a cellulose still containing some nitro groups, I fear.

Mr. Johnson—Our effort was to try to make the conditions as representative of commercial yarn as possible. We used Tubize yarns. I think your observation on the 8 per cent is in accordance with our own idea, only we had thought of using a higher per cent caustic solution. I had in mind that around 10 per cent might be more effective.

Do you ever run across the use of Tussah silk along with your other silk?

Dr. Harold—Yes; they use that as a backing in the embroidery trade. She reason they don't go higher than 8 is not because 10 per cent would be inefficient in a solution of Bourette silk, but they want to avoid the shrinkage of the cotton lace. They try to get the best solution of the silk which will least shrink the cotton embroidery.

Mr. Johnson—At the temperature of the boil?

Dr. Harold—Yes; for the removal of embroidered cotton and the Bourette background, which is afterwards destroyed by the boil.

Mr. Christison—I would like to suggest that from an analytical point of view the use of cold hydrochloric acid as a solvent for the regenerated cellulose might be more accurate and avoid the amount of caustic soda.

Mr. Johnson—I wonder if anybody has made any trials of the estimation of the acetate silk, as by acetone or acetic acid, in an analytical way?

Another nice problem is the analysis of wool, viscose and cotton materials to determine the relative percentages of each.

Mr. Christison—I think you could do that with cold hydrochloric acid, then follow with your caustic.

Mr. Johnson—What strength—concentrated acid?

Mr. Christison—Fairly strong.

ELECTION OF OFFICERS

President Olney—I think the tellers are ready to report in regard to the election.

Mr. Thompson—The total vote cast was 318.

For President—Prof. Louis A. Olney, 308; Prof. Elmer C. Bertolet, 1; blanks, 9.

For Vice-President—William D. Livermore, 306; E. H. Killheffer, 301; blanks, 29.

For Secretary—Walter E. Hadley, 309; blanks, 9.

For Treasurer—Winthrop C. Durfee, 308; Dr. R. E. Rose, 1; blanks, 9.

Councilors for Three Years—William R. Moorhouse, 304; Dr. W. M. Scott, 306; blanks, 6.

Mr. Steele—I might add to that report in connection with Professor Bertolet and Dr. Rose, those two votes were on the same ballot. (Laughter.)

President Olney—You have heard this report, gentlemen. According to our By-laws, this report must be accepted as the election results. I therefore declare these candidates elected.

For myself, I wish to express my appreciation of the courtesy you have extended to me. This coming year will be the fifth year that I have acted as your President. I am very anxious to be relieved from this office another year, so that I can more actively engage in the work of the Research Committee. I think that probably I can do more effective work in that respect than as President of the Association.

There has been some feeling, I believe, on the part of a few that our By-laws should be revised as to the method of nominating officers, and I am thoroughly in sympathy with that view, personally. The way it has worked out, I think it is entirely too easy for the officers to be continued, and too difficult, on the other hand, for new officers to be elected. With that in mind, I believe we shall some time before the next annual meeting appoint a committee to consider this whole subject of By-laws as far as nomination and election of officers is concerned.

We will proceed now to the next paper, "Suggestions for a Simple Standard for Testing the Fastness of Dyed Materials to Light," by William F. Deady.

William F. Deady—Mr. Chairman, in connection with this paper I might say that I haven't done any practical work on it, but I simply prepared it to give you an idea, or rather to put the idea before you to see what you thought of it.

. . . Mr. Deady then presented his prepared paper:

Suggestions for a Simple Standard for Testing the Fastness of Dyed Materials to Light

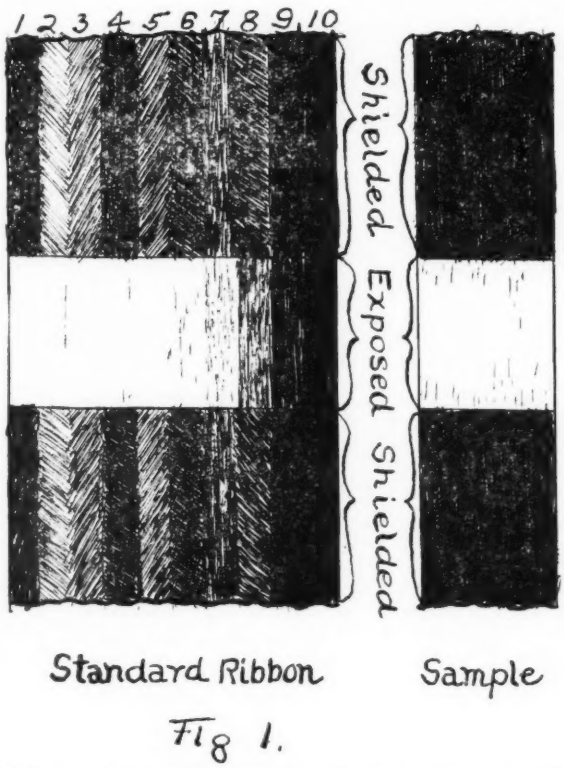
By WILLIAM F. DEADY

In preparing this paper I realized I was dealing with a very complicated subject, one which has been studied by many investigators, who have proposed various methods of establishing fastness-to-light standards. Many of them have been rather complicated to use, while others have been more simple. However, none have been accepted as standard, and the demand at present for some standard is greater than ever. Sunfast guarantees are very freely given to-day, but in many cases they mean nothing more than replacing the faded goods with goods of like fastness, if some purchaser happens to put in a claim. On the other hand, some goods more than stand up to their fastness guarantees.

We must therefore have some arbitrary method of measuring this fastness as we have standardized temperatures, weights and measures, etc. It is not enough to say a color is fast or is not fast, because of the range of fastness of the many dyes we have. A color that may be unsatisfactory for one purpose may be perfectly good for another. Therefore, we need a standard that will indicate this range of fastness.

We cannot go by classes of dyestuffs or methods of application because we have fast and fugitive dyes in the same class, dyed by the same methods. We cannot select any special dyes and call them standard because even our fastest dye, dyed in a one-quarter per cent shade will not stand up to sunlight as well as a 2 per cent dyeing of the same color. Different fibers and different methods of dyeing will vary the fastness of any particular dye. Then again, errors are liable to occur when the tester has to partially construct his own standard.

Fading lamps have also been proposed and there are a few good ones already on the market. They are very valuable in testing some dyes, but owing to the difficulty of exactly reproducing sunlight, they fade some colors far differently than sunlight. There are various other methods I may mention, but most of them are familiar to you, as your Sub-Committee on Light Fastness has made extensive studies along these lines and has reported its results at the annual meetings and in the Year Books.



The Above Would Be Rated as Having a Fastness of Six

Other organizations outside of our own see the need of establishing some suitable standard to test light fastness, and only recently the Cotton Finishers' Association, the Cotton Converters' Association, the Laundrymen's Association and the Federal Trade Commission appointed a joint committee to study this question and devise standards. Considering the personnel of this association which includes the actual makers of dyes, dye salesmen, dyers and chemists as well as the bleachers and finishers of dyed materials, all men in closet touch with the dye situation, with a wealth of technical and practical knowledge of dyestuffs and their behavior, I believe logically, we should be the association to devise the fastness standards.

We must, however, co-operate with these other organizations and the general public, who are only interested in how the dyed material will stand up, and care little what dyes were used or what methods of applying them, and devise some arbitrary standards. Standards to be of such general use must be simple to apply, inexpensive to use, and accurate enough to be of practical value. With these conditions in mind, I propose the following method of establishing fastness to light standards for cotton, wool, silk, and other methods to be similarly made as demanded:

Method

Select ten representative cotton dyes, which, when dyed in the proper percentages will vary in graded steps from fugitive to very fast when exposed to light. They also must fade down uniformly to a definite endpoint under the most important fading lamps as well as direct sunlight. The Barium Photo-electric Cell may be used to advantage in connection with the testing of these dyes to give some idea how much light is required to fade each grade. After establishing the proper dyes to be used they should be purified, thus preventing any foreign ingredients which may interfere with their fading qualities from being present, and also to insure more accurate duplication of both dyestuffs and dyeings. Thus, we have ten standard dyes for cotton.

The next step will be to select the proper staple of cotton, and have it spun into a suitable standard-sized yarn. Scour and dye batches of this yarn with the different standard dyes, using carefully controlled dyeing processes for each to insure accurate duplication. Weave these dyed yarns into a striped ribbon using a warp sateen weave to place the dyeings on the face. A sufficient number of ends of the most fugitive dyed yarn forming the first stripe at the left, calling this

number one, number two being formed by the slightly faster dyeing, number three the next, number four next, etc., until number ten forms the fastest stripe at the right. The filling may be of white yarn to aid in identifying the endpoint after fading. The stripes are to be of sufficient width to definitely show these endpoints. This ribbon may be used as the standard or indicator for testing colored cotton materials.

Representative wool dyes and woolen yarns to be similarly selected to form the wool ribbon for testing woolen and worsted goods, silk dyes and yarns for the silk standard, and other fibers and their dyes to supply the various demands. Printed ribbons could be made to supply standards for printing, etc.

After the various standards are made they should be carefully inspected and tested, then cut into suitable units and packed in light and airproof containers, ready for distribution.

In using the standards, all one would have to do is secure the proper standard, according to the kind of material he wishes to test, cut off a portion and expose it together with the unknown sample side by side. Observe carefully when the unknown has faded to the desired endpoint, look at the standard ribbon beside it and count the number of stripes that have also faded. (See Fig. 1.) Thus, he has a definite fastness value by equal comparison regardless of how long it was exposed or what season of the year.

Summing up the advantages of this system:

First.—The ribbons being manufactured by the association, or by some reliable ribbon manufacturer and controlled by the association would insure uniform, reliable standards.

Second—The expense of highly trained chemists and costly apparatus would be centralized, thus reducing the cost and spreading it out over a large number, making cost per test almost negligible.

Third.—Simplicity of application and reliability of results which may be readily duplicated.

Fourth.—Direct comparison of sample and standard under exactly the same conditions, regardless of season of year or length of time exposed.

Fifth.—Elimination of dyeing errors which are likely to occur when each tester has to make his own standard dyeings, and the saving of this time and expense.

Sixth.—Enabling the general public to place more confidence in guarantees, because with the standards easily obtainable they can make their own tests.

Seventh.—Places the responsibility on the guarantor, because he should know what the goods will stand, before they leave his hands.

Eighth.—Ability to classify colors which fade differently under the artificial fading lamps than under actual sunlight by giving both the fading lamp classification as well as the sunlight classification.

Ninth.—Ability to classify colors which change color long before fading, by giving them a double classification also, first when the original tone changes definitely and second when the color fades to the desired endpoint. This double classification would also be useful in classifying shades made by combining two or more dyestuffs which have different fading qualities.

The above-mentioned type of colors have always been a source of trouble in all systems of standardization, because you cannot say a color has faded when it has merely changed its tone, but in the majority of cases this change of tone is more troublesome than actual fading as the change generally occurs after only a short exposure to light. The use to which the dyed material is to be put governs the importance of this tone change.

Last but not least in the line of advantages of this method would be the revenue derived from the sale of these standards. This, of course, is hard to estimate, but with the laboratory and staff necessary to test the standards, we would have a nucleus on which to build further research work.

Discussion

President Olney—I might say that Mr. Deady suggested this method to me last spring when I was attending a meeting at Providence, and it was with considerable hesitancy that he consented to present a paper in regard to it this time. I think it has considerable merit. I believe it would be well for our Sub-Committee on Fastness to Light to give it careful consideration, and I should like to hear what the Chairman of that Committee, Mr. Cady, may have to say in regard to it.

W. H. Cady—Mr. Chairman, I think that the whole success of Mr. Deady's proposition hinges on selecting proper standards, and from what little experience I have had in this work I think that that would be a somewhat difficult thing: to find a series of, say, ten standards for one fiber, each of which will have a definite end point, so that you can get a gradual series of stages from good to bad, all sharply defined and distinct from each other.

We, as I have already intimated, are just starting to attempt the investigation of all dyes, to pick out suitable dyes for standards, and I will know more about this probably a year from now than I do at the present time, but I think I can foresee some difficulty in that direction.

I will say this: that if proper standards can be found, I believe the scheme is a perfectly practicable one.

Mr. Deady—Mr. Chairman, with reference to picking out ten standard dyes, it may be possible to select four or five different dyes and just vary the percentage used; say, use a ½ per cent dyeing of a certain dye for one stripe in the ribbon, a 1 per cent dyeing for the next stripe and 2 or 3 per cent dyeings of the same dye may

be used for the still faster stripes. Of course, this will have to be determined by experiment. The thing is to get a series of dyed stripes in the ribbon that will fade down uniformly; that is, say No. 1 stripe fades in a day, No. 2 in three days, No. 3 in a week, etc., up to the fastest dye we have. It probably would be better to rate this fading in light hours or some such units rather than days or weeks.

The success of the scheme depends largely upon the selection of dyes; but also upon the dyeing of the yarns and the manufacture of the ribbons with the careful testing of same to insure standard uniform products.

Dr. Joseph F. X. Harold—I might say that the method seems to be established by parallel needs in other lines than the textile field; for instance, in the determination of hardness of minerals. We don't speak of that in definite terms, but always in comparative terms. That is, there are ten different minerals taken for standards and a mineral is said to have a certain hardness, 5 and 6, meaning that it is harder than No. 5 and a little weaker than No. 6.

Dr. Scott's committee, according to its report in the Association Year Book of this year, has done just about what you are suggesting, as far as the fastness to washing of silks is concerned. He has not only spoken definitely of the kind of test to which silk goods can be submitted, but he has printed in the Year Book five different standards. Also, he has suggested and enumerated a number of dyes, each of which would serve as a type for a definite degree of fastness.

There is, however, one point that has to be borne constantly in mind, and it has been referred to constantly in the reports and has been part of the work of the committees; that is, that the stock with which you compare ought to be fairly uniform with the other articles.

For instance, in the bleaching of your goods in dyeing there may be oxycellulose there. You think you are dealing with a pure white, ordinary cotton fiber, but in reality you are not dealing with a pure cotton; you may be dealing with a cotton that has a large amount of oxycellulose in it which will play havoc frequently with your colors, and your standards may be prepared in an entirely different way; the white goods from which your standards may be prepared may be made in an entirely different way.

I think the local plan would be, if you are near enough to a loom, to actually weave with your standards the dyed material under test, so that the white goods could start from the very same white goods stock, prepared from the very same white goods.

Mr. Deady—Mr. Chairman, that rather gets away from the idea of the proposed standard. I believe in having the Association prepare or control the production of these standards, and compare everything else with the standard. That is, it makes no difference what kind of colored cotton cloth, yarn or raw stock you are testing, in order to determine its fastness to light it must be exposed along with a portion of the standard cotton ribbon. If five stripes on the ribbon have faded before the sample fades but the sixth stripe is still visible, you would classify the sample as having a light fastness of five.

If the standards are all prepared and tested at one source, you eliminate the many little errors that are bound to creep in when dyeings are made at various sources by different men, even though the same dyes are used.

You wouldn't think of getting the materials to make your own thermometers or yardsticks when you can buy them much cheaper already prepared from some reliable manufacturer who specializes in these goods.

In regards to oxycellulose in cotton goods, you will have a hard time dyeing them evenly if this is present, and material of this sort should stand on its own merits against the standard ribbon.

Also, it is impossible for the majority of people who would like to know the light fastness of a dyed fabric to have access to a loom, and, furthermore, especially on cotton piece goods, if you weave the stripes in with the goods most of them would be destroyed during the boil and bleach.

Mr. Christison—In connection with Mr. Deady's remark, I would like to say that for five years we had a standard similar to what he suggests and we took Columbia Black F. It gives a beautiful neutral gray when dyed thin, and by having several dyeings from a thin gray to a heavy black we got shades that were very fugitive at one end and a black that was practically unfadable at the other end, and we found it very useful.

President Olney—I wish to make an announcement in regard to the rest of our program for the morning, so that you will know where we stand and where we are going.

We will endeavor to adjourn promptly at 1 o'clock. The paper on "Waterproofing Textile Fabrics" will be put over until this afternoon, so that it will be the first paper, and will be presented at 2 o'clock. The rest of this morning, which will be about forty minutes, will be given over to William D. Appel, who will present a paper entitled "A New Lamp for Fading Textiles," and he may also speak of some of the work that he has been doing in connection with the Research Committee. We hope that he will leave a little time for discussion.

William D. Appel—Before I start this paper I should like to say, with reference to Mr. Deady's suggestions, that in my opinion the fundamental difficulty in fastness to light tests is that we are not concerned with the action of light alone but with the action of light plus environmental conditions, and the environmental conditions vary,

of course. The effect of humidity is brought out in these samples which the Research Committee has on exhibit at the rear of the room.

If we had a series of ten dyeings which faded in steps with respect to one another under one set of conditions, under another set of conditions they might fade quite differently.

Mr. Deady—In answer to that I will say that your unknown sample is always exposed under the same conditions. That is, you cut off a portion of your ribbon and expose it with your unknown sample. The conditions prevailing are the same in both cases.

Mr. Appel—But it is the relative fading in your series of standards that I refer to. For instance, No. 2 in the series might fade no more than No. 3 or 4 in high humidity. In other words, your series would be disrupted if the conditions varied greatly at one time from another. Vice versa, your unknown samples under one set of conditions might fade very little, and yet under another might fade markedly and be placed lower down in the series.

That is simply one consideration. I would say that I am convinced we must select some such standards as Mr. Deady has suggested here for all practicable work. We are going ahead to try to get the standards which will behave the best in practice.

. . . Mr. Appel then presented his prepared paper:

A New Lamp for Fading Tests

By William D. Appel

There has been built at the Bureau of Standards an apparatus for laboratory fading tests in which the light is furnished by a large incandescent lamp. The results of preliminary eperiments were given before the Dye Division, American Chemical Society, last spring. A description of the apparatus and of the results obtained with it to date may be of interest here. Some of these tests are on exhibit in the rear of the room, where are also the photographs and drawings referred to here.

Description of the Apparatus

The apparatus is shown in these photographs and drawings. The bulb of the lamp with base up is surrounded by a 1 per cent solution of copper sulphate contained in an inverted bell jar. The solution is used to absorb the heat given out by the lamp and is circulated from it to cooling coils in a second jar and back to the lamp by means of a small pump. The samples are mounted in a vertical position on arms from a disk below the bell jar so arranged that the disk may be rotated by the same motor which drives the pump, moving the samples slowly around the lamp and compensating for the irregularity in the arrangement of its filaments, variations in the thickness of the copper sulphate solution, or flaws in the bell jar. The distance from the center of the lamp bulb to the samples is about 5 inches. Two rows of twelve samples, twenty-four in all, may be exposed at one time. The samples are 2.5 x 3 inches in size. The upper half of the samples in the upper row and the lower half of those in the lower row are covered. Two exposures may then be made on the remaining portion of the dyeing on rectangular regions about 1¼ and 1½ inches in size, both in contact with the unexposed portions.

The part of the apparatus comprising the lamp, bell jar and samples is enclosed in a cabinet so that the atmosphere about the samples may be controlled. In the earlier experiments high humidity was obtained by blowing air nearly saturated with water into the cabinet and low humidity by passing in air from a drying train. In the later experiments the bottom of the cabinet has been filled to a depth of 3 or 4 inches with either water or a salt solution, and a small electric fan has been used to keep the air in the cabinet in motion. A humidity recording device is mounted on the side of the cabinet and a wet and dry bulb psychrometer used to calibrate it. The temperature within the cabinet is determined by the conditions of operation. The highest temperature used has been 45 deg. Cent., and most experiments have been made between 30 and 40 deg. Cent.

The apparatus is, as you see, home-made from materials at hand. It can be much improved and simplified. However, it does make possible light exposures under definite reproducible conditions.

Comparison of the Light with That from Other Sources

Spectrograms of the light from this lamp, the Fade-ometer and the sun are compared in Fig. 4, one of the photographs exhibited at rear of the room. The incandescent lamp differs from the Fade-ometer and resembles the sun in having a continuous spectrum. It does not radiate much beyond wave length 335, the solar spectrum going to 290. However, because of its glass globe the Fade-ometer is likewise deficient in this region and, moreover, shows deficiencies in the near ultra-violet and visible interspaced between regions of excessive radiation.

The copper sulphate solution removes the large excess of radiation of long wave lengths from the light of the incandescent lamp without greatly reducing the radiation at the violet end of the spectrum. The spectral distribution of energy in the light is thus made more like that in sunlight.

Although the incandescent lamp is deficient in ultra-violet radiation compared with other artificial sources, such as the Fade-ometer or mercury arc lamp, it must be remembered that sunlight at the earth's surface has a very limited amount of its total energy in the ultra-violet and,

moreover, that colored textiles, unlike paints, for example, are seldom exposed to the direct rays of the sun for long periods of time. In fact, it might be expected that tests made with a sufficiently powerful incandescent lamp properly screened would duplicate sun tests, especially when they are made under glass, as is customary in the textile industry.

Results of Exposures in the Lamp

All except the earliest experiments were made with the 1,000-watt gas-filled Mazda C lamp, using a special constant voltage line, and were all made within the first 300 hours of the life of the lamp, which is rated as 1,000 hours. The light may thus be regarded as constant.

The dyeings used were Series II and Series III of the Sub-Committee on Light Fastness, which, as Mr. Cady has said, are representative of a variety of dyeing classes on cotton, wool and silk. Each series consists of twenty dyeings.

The effect of humidity on the fading produced when other conditions are constant is shown by the following comparisons: Set 37 of Series II exposed in an atmosphere having an average humidity of 91 per cent shows distinctly more fading in five cases than set 36, humidity 25 per cent, exposed for the same length of time. Set 48 of Series III, which fades more on the average than Series II and is therefore better for our purpose, exposed in 94 per cent humidity has faded more in sixteen out of the twenty cases than set 59, 35 per cent humidity. In no case has a low humidity exposure faded more than a high humidity exposure for the same time.

It is noteworthy that certain samples have not only faded more in the high humidity exposure, but show a marked difference in the quality of the fading; that is, they show a hue change in the high humidity exposure not noted in the low humidity exposure.

Sets 59, 49A and 49B were exposed in low humidity for respectively one, two and three times the duration of the high humidity test, set 48. Eight of the twenty samples have faded distinctly more in the high humidity exposure than in three times the exposure in low humidity, two have faded to the same extent, and the remainder have faded somewhere between sets 59 and 49B.

It is evident from the results set forth that humidity plays an extremely important part in the rate of and the nature of fading. High humidity increases the rate of fading of many of the materials tested, although it has no apparent effect on the rate of fading in some cases. It appears safe to conclude that the effect of humidity varies markedly with the sample under consideration.

These incandescent lamp exposures may now be compared with sun and day light exposures and with Fade-ometer exposures. Set 37 exposed for forty-three and eighty-six hours in high humidity agrees very well indeed with sun tests made at Fall River, Mass., between 9 a. m. and 3 p. m. during January, February and March for periods of 70 and 140 hours. Fade-ometer tests of eighty hours' duration show marked divergencies from sun-fading in a number of cases. Not only are the incandescent lamp exposures qualitatively more like the sun tests than those made with the Fade-ometer, but the speed with which the incandescent lamp has produced fading is satisfactory as compared with the Fade-ometer and sun.

Turning to exposures in Series III and comparing with the daylight tests referred to in Mr. Cady's report (and here exhibited), the results are not so conclusive, though I believe the reason is not far to find. We have in set 42 a typical June sun test made under glass, 45 deg. facing south, with circulation of air, for 46.7 hours, between 9 a. m. and 3 p. m. only. Set 47, on the other hand, was exposed continuously facing north for eight days in a cabinet similar to that used for 42; i. e., the samples were protected from the weather by glass, but outdoor air circulated freely about them. The average humidity of the atmosphere about set 47 was much higher than that about set 42. Now, some of the incandescent lamp exposures of set 48, 46.7 hours, humidity 94 per cent, have faded much more than in the sun test and some of them less.

How can this behavior be accounted for? It is probable the 1,000-watt incandescent lamp is not bright enough. Samples which are not much affected by high humidity are not faded enough. Samples which are most affected by humidity are faded too much. Although the set as a whole does not resemble the sun test, it is much more like the north sky test If all the sun and sky exposures made under different conditions be compared with the incandescent lamp exposures, it may be said that, although no two sets are alike in every respect, in general the incandescent lamp exposures resemble one or another of the sun exposures very well indeed.

It is possible that by using a more powerful lamp and adjusting the humidity and atmosphere properly, the different sunlight exposure results may be duplicated. It remains to be seen whether the apparatus which will produce this result will be practicable for everyday purposes.

Discussion of "A New Lamp for Fading Tests"

President Olney—I am sure there is an opportunity for discussion on this very interesting subject. In recent years, the use of some artificial light has, of course, become more hopeful than sunlight on account of its uniformity, and also the fact that we can have the light at any time. It would be very interesting indeed to have the experience of those who have worked with these artificial lights.

Dr. Edwin E. Slosson—I would like to ask what per-

centage, on the average, of solar radiation is in the ultra-violet region.

Mr. Appel—I can't tell that exactly. Dr. Coblentz, at the Bureau of Standards, has made measurements which extend from the limit in the ultra-violet into the visible. I think they border over into the visible. The figure is very low, though. It is 5 per cent, or something like that, as I remember it.

Dr. Slosson—I should like to ask also what is the comparison between the fading effect of direct sunshine compared with the total light received from the sky outside of the sun.

Mr. Appel—You mean the total energy received in producing the fading?

Dr. Slosson—Yes. I mean if you expose one piece to the sun itself without receiving any light from the sky, another piece where the sun is dimmed, and there is only the light from the sky, how would they compare?

Mr. Appel—I can't answer that question because we didn't perform the experiment. While it might be interesting, of course, the sun fluctuates so markedly, even from hour to hour in the same day, that it would hardly be of practical value with respect to these standard tests. We know that the percentage of sunlight direct from the sun, excluding the skylight, is—I hesitate to quote the figures, because I am not sure of them—I think, 80 per cent, or something like that, on a clear day.

Dr. Slosson—The reason I ask that is because it has been reported that in the actinic region of the ultra-violet and violet region we get more energy from the reflected light, from clear sky, than we get from the sun at noonday.

Mr. Appel—I think that is true, because the proportion of ultra-violet to visible in the light that comes directly from the sun is fixed; I mean the ratio is fairly definitely fixed by the atmosphere it passes through; but when the light is diffused, the red end of the spectrum is cut down. The sky is blue for that reason. We get proportionately more radiation near the blue and violet end of the visible, and a larger proportion with respect to the total amount of light in the violet and ultra-violet.

Dr. Slosson—It seems to me the question is worth consideration from a practical standpoint, because in the fading of cloth, for example, we are ordinarily more or less protected from the sun either by the man working in the shadow or the woman carrying a parasol, but they are exposed to the action of the reflected sun or refracted sun's rays from the blue sky around at all times.

Winthrop C. Durfee—Didn't you make some experiments with the north light?

Mr. Appel—We made north light experiments, continuous exposures.

Mr. Durfee—Wouldn't that give some explanation to the subject?

Mr. Appel—Mr. Cady gave a summary of the results we got, this morning. The north light exposures were continuous, and they were high humidity for a good bit of the time. We got the humidity effect on those dyeings which go away off shade in high humidity; and those dyeings, as well as some others, faded much more than they did in the sun—I won't say "much more," but they faded very markedly. You can judge from the samples which are in the back of the room. Others didn't fade nearly enough compared with the sun exposures.

I should say that under continuous exposure, 45 deg. facing south, taking the days as they came, we got the same large differences for certain dyeings from the sun exposure only between the hours of nine and three, and when the sun was shining.

President Olney—Unless one has studied into the variation of direct sunlight, I do not believe one appreciates the variation that there is between two days which might be pronounced by different people as being identical as far as clearness is concerned. For instance, here is one day with a very clear sky and a low humidity and no apparent smokiness of the air—and you will get a very high fading. Yet on another day you might ask the same person, "Is this a fine day?" and he would say, "Yes, it is a beautiful day," but in reality it might be a little bit hazy and there might be a considerable amount of moisture in the air—and you will find there will be quite a little variation. Of course, if there is enough moisture it may increase humidity, and it may counteract the other fading to a certain extent. But I believe that that variation between two days is far greater than the ordinary person suspects.

Mr. Appel—In further answer to Dr. Slosson's question, we made exposures 45 deg. facing south, one set out only when the sun was shining, the other set out only when it was cloudy; one set was exposed, as I remember it, for forty hours or forty-three hours, and the other set for forty-nine hours. The cloudy exposure was not quite as much faded as the direct sun exposure, but it was so markedly faded that I kept it because I was very much surprised at the results.

We had a photo-electric cell out at the same time, and the amount of energy recorded by the cell was much lower in the cloudy sky exposure than in the sun exposure, yet the fading was comparable. Of course, there is again the humidity factor there. In the cloudy exposures the humidity was some 15 per cent higher than in the sun exposures, and that the humidity effect on these dyeings would show a hue change in high humidity but no change in low humidity is perfectly evident.

Dr. Slosson—I don't see that the cloudiness experiment answers the question, because the cloudiness would also interfere with the refracted light as much or more than it does with the direct sunlight. Someone has said that

it would be impossible to try an experiment like this. I don't see any difficulty to it at all. All you would have to do would be to put a sheet of cardboard over your sample and shield the sun away from it.

President Olney—Are there any further questions on this particular phase of the subject? If not, there are a few minutes left. I think perhaps Mr. Appel has some other matters he might bring to us at this time.

Mr. Appel—No, I haven't.

President Olney—Are there any other matters to come before the Association before we adjourn for lunch?

R. L. Chase—There is one matter I would like to mention, and that is the difference in the depth of dyeing. Take certain dye tests on cotton—for instance, Indigo; a light shade is very, very fugitive and will not stand exposure for one day without showing, whereas a dark Indigo will stand exposed for months without showing much change. On the other hand, there are some direct dyes of a red nature which when dyed to a heavy shade fade very much indeed, and when dyed to a very light pink will stand for days. I don't know whether that has ever been brought to the attention of the Association or not. It is one of the peculiarities of the fading study.

W. H. Cady—I would like to ask Mr. Chase if he can name some of those dyes.

Mr. Chase—Indigo, I think, and Erika, I believe, is the other. I am not sure about that; I think it is Erika. But I can check up on that and will be very glad to let you know.

Mr. Cady—Mr. Chairman, I want to put into the record something which perhaps was not included in the report of the Committee. From a statement that Mr. Chase made earlier in the morning, it is evident that he doesn't understand just how long we exposed the various sun tests in order to make the fading approximately equal.

For instance, when we made a comparative north light and south light test, we didn't leave the two exposures out for the same length of time, but we left the north light exposure out enough longer so that the average fading of the twenty samples was equal to the average fading of the twenty samples in the south exposure. That was the method used in all our samples.

Mr. Appel—I might mention that Mr. Deady said we should be represented on the Converters Association Committee, which is now working on standard tests. As a matter of fact, Professor Olney is a member of that Committee.

President Olney—Mr. Appel is also a member of that Committee, so I think we are fairly well represented there (Laughter), though it may not be official.

Mr. Appel—I should like to ask Mr. Deady just one more question, and that is: How can a sample which fades darker, to use the expression, be classified in your comparison series?

Mr. Deady—I should say it can be classified in a way. If it changes darker or lighter, it changes its original tone; your first classification would be where the change came, and if it kept getting darker, it would be as fast as the fastest colors.

President Olney—Are there any further remarks or questions?

Mr. Bannan—I think we could devote the remaining ten minutes to examining those exhibits in the back of the hall.

President Olney—If there are no further questions, I think that is a good suggestion.

. . . The meeting adjourned at 12.50. . . .

SATURDAY AFTERNOON SESSION

December 5, 1925

The Saturday afternoon session convened at two o'clock, Prof. Louis A. Olney, President, presiding.

President Olney—Our first paper this afternoon is the one that was to have been presented last on this morning's program, "Waterproofing Textile Fabrics," by Mr. Herbert P. Pearson. (Applause.)

Waterproofing Textile Fabrics

By Herbert P. Pearson

Mr. President and Gentlemen: I was a little bit anxious earlier in the day, because for the last few years I have been more of a salesman than a chemist, and I am almost wholly ignorant of hydrogen ions, but since you have all eaten lunch, and as the effect of lunch is to abstract a little blood from the brain downwards, I feel a little easier in mind.

I am not going to read a paper and I am not going to deliver a lecture. What I want to do is to give you a purely informal talk on certain aspects of the waterproofing of textile fabrics, which is a very suitable subject for this particular day. (Laughter.)

As I have to introduce one or two new ideas, I want to begin with a little story. A friend of mine invented a machine for blending cigarette tobacco. He worked it up, produced the machine, produced the cigarettes, trade-marked them, put them in little boxes, and then approached the august president of the largest cigarette manufacturing company in the world. The president was very skeptical, as presidents usually are. He said "I don't believe that you can blend equal to our X brand." So he gave him samples of their X brand, samples of the various tobaccos that entered into it, and asked him to imitate it.

My friend, being an eminent engineer, was a little little bit peeved at his attitude. He took the X cigarettes home, took out the tobacco that was in them,

put them in the place of his own tobacco that was in his own cigarettes marked with his own trade-mark and, after a suitable interval, returned to the president of that company. He gave him one of the cigarettes which he had apparently imitated. The president lit it, smoked it, and then smelt it, and an expression of disdain began to come into his face. His criticism consisted of two words only. One was "bah," and the other was "rotten." (Laughter.)

That, gentlemen, is fairly typical of the attitude of the average president toward the average new idea that is put up to him, but you, all being chemists accustomed to new ideas and also, incidentally, accustomed to having them turned down by general managers and the like, I hope will be more receptive.

I have three suggestions to make. One of them has to do with renaming, one with regulating, and the other with research—three "r's."

I suggest that we cease calling waterproof fabrics those which are not waterproof, and substitute for them the term "water resisting." The dictionary defines waterproof as "impervious to water." A broader and a more accurate definition, perhaps, is that a fabric is waterproof when it is impervious to water under the maximum conditions of actual pressure that it is liable to be subjected to in use.

Fabrics are surfaces with holes. In some fabrics the holes are larger and in others they are smaller. One thing we know absolutely is that *we can't waterproof a hole*. Therefore, I propose, as my second suggestion, a simple test to distinguish fabrics that are waterproof and those which are merely water-resisting, and that is a combination of a smoke test and an absorption test.

If you take a mouthful of cigarette smoke and try to blow it through a waterproof fabric and the smoke goes through, then that isn't a waterproof fabric under all conditions. If, in addition to that, you apply an absorption test like that one devised by the leather and paper laboratory at Washington, you get an accurate criterion as to what is waterproof and what is only water-resisting.

The application of a test like that reveals the fact that the only real waterproofing processes are processes of coating—coating with drying oils, rubber compounds of Pyroxylin. These coatings are, however, somewhat too expensive in actual practice. So the usual method is to impregnate the fabric with heavy impregnations which fill up its pores, and those fabrics which have pores permanently filled with a water-resisting compound are waterproof. Such processes are used, of course, mainly for heavy cotton goods. Water-resisting process, on the other hand, are more important for light goods, wearing apparel, awnings, and things of that kind.

The wearing apparel processes consist in applying substances (waxy substances as a rule) to the fabric by spreading, spraying or impregnation, and their function is to alter the surface tension as between fiber, water and air, so that there is a reduction in the absorption for water on the one hand and a slowing up of the actual seeping of the water through the pores on the other hand.

You can in your laboratories make a very interesting test of this surface tension phenomenon, with the theory of which you are, of course, all familiar. Take an ordinary 100 c.c. glass cylinder and have a small hole bored through the side right at the bottom. Pour a drop or two of an ethereal solution of ordinary paraffin into the hole and let it evaporate. Then put a long tube funnel into the cylinder and gradually pour in water. You can get the water up from one inch to eight inches, according to the diameter of the hole; but if you do this for the aforementioned president or general manager you must be sure to wiggle a wire in that hole, otherwise he won't believe there is a hole there at all.

You may ask, "What is the need for water-resisting processes as distinct from waterproofing processes?"

Gentlemen, the need is obvious. You dyers, before you are able to get in your dyes, take out the water-resisting oils which are naturally in the fiber and you never do anything to replace them. What is the result? Our soldiers in the winter time with those 32-ounce olive drab overcoats on in rainy weather are marching along with two or three pounds of absolutely unnecessary weight, in the form of absorbed water. Your own overcoat, after you have been out in a storm, takes hours to dry. If it has a water-resisting process on it, it dries out in about an hour. Surely, that is a useful application of water-resistance.

Then, in connection with women's apparel, silks, fine cotton goods, velour wool goods—they are damaged by accidental aqueous spills and splashes or showers. This is absolutely unnecessary and water-resisting processes should be used.

That brings me to my third idea: Research work is absolutely needed before the application of water-resisting processes can become universal, because of the fact that wearing apparel goes to the dry cleaning establishment where it is subjected to a solvent naphtha, which dissolves out practically all of the water-resisting material. So that, obviously, the water resistance that you pay a little extra for, goes away whenever you send a garment to be cleaned.

Would research into this pay? That is, would it pay if we could devise water-resisting processes for silk, wool, cotton and rayon, which would not be dissolved out by naphtha, but which would reduce to a practical extract the absorption of accidental water

and aqueous liquids? I say that it would if—. The first "if" is if you get suitable finishes for all of the fibers; the second if you have sufficient funds available for the eventual education of the people to the value of the extra cost entailed.

My object, then, is to ask you to give me your ideas on this distinction between waterproofing and water resisting, and also on the need for research. It is now your turn to speak. (Applause.)

President Olney—Mr. Pearson has certainly opened the way for questions on the subject of waterproofing. We can devote a few minutes to a discussion of this subject. It certainly is a very interesting and a very important one, and if there are any questions in the minds of some of you, we will be glad to have them now. . . . Hasn't someone a question? If not, we will pass on to the next subject, "The Coloring of Acetate Silk," by H. R. Davies.

. . . Mr. Davies presented his prepared paper:

Recent Developments in the Coloring of Acetate Silk

By Harry R. Davies

The total production of acetate silk in the United States, compared with the production of other rayon fibers is very small and though it is rapidly increasing, the estimated production for 1926 is less than 5 per cent of the total amount of rayon manufacture projected. At first glance, therefore, it would seem that the attention which has been paid to this fiber both by manufacturer, chemist and dyer is altogether disproportionate to its importance.

A closer inspection, however, of the properties of acetate silk, both chemical and physical, will show that this widespread interest is not at all misdirected. Here is a fiber with a luster, softness and pliability approaching that of real silk, a splendid heat insulator, a fiber that does not materially lose its tensile strength when wet and one that does not readily absorb moisture or perspiration. These are enough to engage the attention of the manufacturer of all articles of clothing, particularly those which are worn next to the body. In addition, however, it soon became apparent that the unique dyeing properties of acetate silk provided a means of obtaining multi-colored effects in piece dyeing with a facility that none of the other rayon fibers could afford.

A year ago before the Northern New England Section I traced the history of acetate silk from a dyeing standpoint.

In the early days the dyeing of acetate silk was beset by enormous difficulties—most of the dyes used for the coloring of other textile fibers did not dye acetate silk at all and those that did suffered from the fact that they did not dye full shades and were loose either to light or washing. Only a few selected colors from the various ranges of established dyes could be used and compound shades often had to be obtained by combining colors of different classes, often with varying dyeing properties—an irrational and naturally hazardous undertaking. Various trick methods of applying existing types of dyes were patented, recommended and used but the basic difficulties were not removed until fundamental research — carried out largely in England—resulted in the placing on the market of such colors as the Ionamines, the SRA, Duranol and Celatene colors which were devised for use solely in the dyeing of acetate silk. To-day it can be said that the dyeing of acetate silk is a simple task.

I do not intend to again go into details regarding the constitution of these dyes or the dyeing methods adopted for the various types. For the past few months the official organ of this society, the American Dyestuff Reporter, has been and still is publishing a series of articles by Chas. E. Mullin which have in the most thorough and painstaking manner reviewed the entire history of the dyeing, finishing and printing of acetate silk. In fact, so well has this been done and in a medium which is so readily available to you all that I hesitate to take up any considerable time with my remarks.

It is interesting, I think, as showing the soundness of the research that led to the SRA, Duranol and Celatene colors, to note that these colors have been followed by dyes of German and Swiss manufacture which are undoubtedly based on the same dyeing principle, i. e., the absorption by acetate silk of certain insoluble or very slightly soluble colors from a colloidally dispersed dye bath.

But though the production of shades in limitless variety has been made possible by the adoption of this dispersion method of dyeing, it must not be understood that all of the problems relating to the dyeing and printing of acetate silk have been satisfactorily solved. The chemist's interest is still maintained, the research still goes on and new discoveries, particularly in the production of special effects are constantly being made.

Dyeing Mixed Fabrics with Sulphur Colors

It is well known that all alkalies, especially at elevated temperatures, will saponify acetate silk. The saponified acetate silk being simply a regenerated hydro cellulose will then lose its distinctive dyeing properties and behave more like the other rayons or cotton.

Mixed fabrics consisting of acetate silk and cotton can be dyed with sulphur colors, and the operation if carefully conducted in the cold leaves the acetate silk undyed, so that it may be cross-dyed in contrasting shades to produce two-tone effects with Duranol or other colors of the dispersal type.

There is a danger, however, due to the strongly alkaline nature of the dye bath, that the acetate silk may be partially saponified. If this takes place the sillk becomes stained with the sulphur color and at the same time loses to some extent its affinity for the special acetate silk colors and as a result dull and unsatisfactory two-toned effects are obtained. This process has recently been made considerably safer to apply. The British Dyestuffs Corporation and H. D. Mudford have been granted a patent for the use of ammonium salts as an addition to the sulphur color dye bath. The acetate silk-cotton-union material can with this addition to the ordinary sulphur color dye bath be dyed at 75 to 85 cent., at which temperature there is no hydrolysis of the acetate silk. It is, therefore, not dyed by the sulphur color and is left in perfect condition for the production of two-toned effects.

Owing to the fastness to light of the Duranol and Celatene colors, it has been found desirable to use these colors in combination with the vat dyes in the two-bath production of bi-colored effects on viscose and acetate silk for drapery and upholstery purposes.

The usual method of procedure is first to dye the acetate silk with Duranol colors and then to pad or jig dye the cotton or viscose with vat colors.

Here again we are confronted with the same difficulty: the caustic soda used in vatting the vat colors decomposes the acetate silk, which, after some time in the dye bath, exhibits an affinity for the vat dyestuff and becomes badly stained.

It has been recently discovered by British chemists that by adding certain organic hydroxyl compounds to the vat dye bath the acetate silk is protected from damage and brilliant two-toned effects are readily produced.

It is frequently stated that acetate silk has no affinity for the usual soluble salts of metallic mordants, though H. S. Mork, of the Lustron Company, has proposed the use of a strongly acidified solution of chrome acetate as a chrome mordant for Lustron.

Another new process, which, however, from the experimental work we have recently carried out, does not appear at the moment to be of great technical importance, has been worked out and patented by the British Dyestuffs Corporation. It has been found that acetate silk has a considerable affinity for the sulphocyanides of the metals, and acetate silk can be mordanted with alum, iron, tin, chromium, etc., by immersion in solutions of their sulphocyanides. The mordanted fiber can, of course, be subsequently dyed in fast colors by using the true alizarine and chrome dyes.

Metallic salicylates can also be employed for this purpose, but with less satisfactory results.

As has already been stated, acetate silk is particularly interesting to the dyer because of the ease with which bi-colored effects can be produced by the use of acetate silk in combination with any other rayon or vegetable fiber.

Further Notable Developments

It is, of course, possible to produce similar effects by the use of acetate silk in combination with wool or with natural silk. A difficulty arises, however, in this connection that is not noticed with the vegetable fibers. While most of the special acetate silk colors only slightly tint vegetable fibers, they nearly all possess a more or less marked affinity for the animal fibers, and these are generally stained or dyed to a greater or less extent. By judicious choice of coloring matters, however, it is possible to produce three-colored effects on cotton, wool and acetate silk fibers from one bath.

As the working out of these various dyeing problems is being gradually brought to a satisfactory conclusion, more and more attention is being paid to the printing of acetate silk.

To a certain degree the printing of acetate silk offers but little difficulty, but this can only be regarded as true if we are considering only the direct printing of an all-acetate-silk piece of goods.

Even the direct cotton colors which have no affinity for acetate silk can be printed with an alkaline thickener and steamed to produce prints of ordinary direct color fastness, local or surface saponification of the printed portions of the acetate silk being, of course, the reason for the fixation of the dyestuff.

The Ionamines and Duranols can also be printed by simply thickening the color, printing and steaming without pressure for fifteen to thirty minutes. The same applies to the basic colors; in which case, however, acetic acid is generally added to the printing paste. The vat colors and some sulphur colors can be printed by using the following method:

10 grams vat color paste
2½ to 5 grams Sulphoxite C
3 c.c. glycerine
25 c.c. caustic soda 76 deg. Tw.
75 c.c. British gum (6 lbs. to gallon)

Print, age five minutes at 212 deg. Fahr., rinse and soap at 180 deg. Fahr.

The chrome colors may be applied in the regular way

with a chrome mordant, but only a short steaming must be used in order to preserve the luster of the silk.

An interesting bi-color print can be obtained on cotton-acetate silk union by using a single color paste containing both CR direct colors and Duranol colors. The recipe is:

2 grams CR color dissolved in
10 grams glycerine
23 grams hot water and
60 grams British gum thickener

When dissolved and cool, add 5 grams Duranol color paste. Print, steam fifteen minutes at 212 deg. Fahr. without pressure, and wash off.

Discharging of Acetate Silk Piece Goods

One of the problems at present engaging the attention of the printer is the discharging of dyed acetate silk piece goods. Dischargeable direct cotton colors are being dyed on acetate silk which has been saponified either with or without a protective medium in the saponification bath. Such colors are dischargeable with the usual reducing agents, though generally somewhat stronger discharge pastes must be used and care must be taken in the washing to prevent the whites from being sullied.

When dealing with unsaponified acetate silk it has been almost impossible to obtain good whites, and colored discharges have been the only really satisfactory ones produced. The following colors are suitable for the ground color if the goods are to be subsequently discharged with hydrosulphite:

Cellutyl Fast Golden Yellow
Cellutyl Orange 2R
Cellutyl Fast Orange G
Cellutyl Sky Blue
Cellutyl Fast Red D
Cellutyl Fast Lilac
Acronol Brilliant Blue

It is an unquestioned fact that certain colors of this class which theoretically should be readily dischargeable with sulphoxylates and are, where applicable, easily discharged on other fibers, cannot be discharged when dyed on acetate silk by the ordinary sulphoxylate discharge. I am, however, just in receipt of a communication from the British Dyestuffs Corporation advising me that by a simple addition to or modification of the existing discharge process such undischargeable colors become easily discharged. The process, which is novel, has not as yet reached its full stage of development and, as it is to be the subject of an application for patent, the exact method cannot be divulged at the moment.

The regular basic colors which are commonly used for color discharges in conjunction with sulphoxylates can, of course, be used for the production of colored discharges on acetate silk.

The Duranol and Celatene colors do not satisfactorily discharge as a class, and many of the other colors applied from dispersed solutions suffer from this default. However, the following range of colors on acetate silk can all be discharged to a satisfactory white by means of a chlorate discharge:

Duranol Blue G in light shades
Duranol Red 2B
Cellutyl Fast Orange R
Cellutyl Bright Yellow
Cellutyl Bright Red
Cellutyl Bright Greens B and Y
Cellutyl Sky Blue
Cellutyl Fast Blue
Cellutyl Fast Gray
Cellutyl Fast Lilac
Methyl Violet 2B
Methyl Violet 10B
Acridine Orange L

The art of printing makes severe demands on both the color maker and the textile colorist, and the printer of acetate silk has no such heritage of experience in its manipulation as has the printer of silks and cotton. It is not to be expected, therefore, that he can immediately solve all the problems which the attempts to print acetate silk disclose. However, the energetic manner in which so many of the difficulties surrounding the dyeing of acetate silk have been tackled and overcome leads us confidently to expect an early solution of the more pressing problems of the printer.

Discussion of Developments in Coloring Acetate Silk

President Olney—I am sure Mr. Davies is willing to answer any questions. We will be pleased to have any discussion of this paper. It need not necessarily be in the form of questions.

W. H. Cady—Mr. Chairman, I would like to ask Mr. Davies about certain acetate silk dyes on the market now that are solid powder colors.

Mr. Davies—There are certain dyes that have been put on the market recently which are solid powder colors which have a dispensing medium mixed with the dyestuff. I think that is what they are. (I don't know the particular dyes to which you refer or their constitution.) I imagine, however, from what I have seen of some of these later dyes that they are dispersion dyes, but the powder of the dispersing medium is ground in with the dyestuff so that they form a dispersion rather than a solution when you use them.

President Olney—Are there any other questions?

John F. Warner—I would like to ask Mr. Davies if, in the dyeing of union goods containing Celanese and cotton, where the vat colors are to be used, the dyeing of the Celanese in that case is a hydrolysis proposition?

Mr. Davies—In the patterns which are passing around, the acetate silk is first dyed with the Duranol color. The acetate silk is not hydrolyzed. The Duranol colors are those dispersion colors which dye the unhydrolyzed silk, and there is no difficulty in leaving the cotton or viscose white. In cross-dyeing these fibers it has been found that there is a tendency, because of the alkaline nature of the dye vat, to stain the Celanese, Lustron or acetate silk through hydrolysis, and the method suggested is to avoid such staining and produce brilliant two-toned effects.

Mr. Warner—In other words, it is quite possible, then, if you dye the Celanese first, to afterwards pad the union?

Mr. Davies—It is quite possible, and it is being done on a large scale.

W. H. Cady—Mr. Davies, is there a direct black for Celanese yet?

Mr. Davies—I think we have sold the Pacific Mills a few pounds of one, Mr. Cady. It is not a very good one or a very strong one, but it is a black and it will dye a black.

J. A. Pawson—What per cent?

Mr. Davies—Don't ask me that. (Laughter.)

Mr. Pawson—We have tried up to about twenty-five or thirty, and didn't succeed.

Mr. Davies—I think you must go to forty, Mr. Pawson.

[*This ended the discussion on "Recent Developments in the Coloring of Acetate Silk." The report of the Saturday Afternoon Session, including further papers presented and the discussions that followed, will be concluded in the next issue of the Proceedings, which will also include the report of the Fifth Annual Banquet.*]

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ERRATA

[EDITOR'S NOTE.—The following corrections have been made by Stewart F. Carter in the printed report of his address at the Open Forum of the Annual Meeting, published in the December 14 issue of the Proceedings. Owing to the limited time between the delivery and publication of the report it was impossible to send copies to authors for correction before publication.

The page numbers refer to the pages of this publication.]

Page 829, *Column One*:

Line 42—For *"purpurine," read "garancine."*

Column Two:

Line 5—For *"sodium,"* read *"soap."*

Line 13—For *"of* the *acid* of aluminum paste *and,"* read *"to* the *acetate* of aluminum paste *of."*

Line 9—Comma after "dyeing."

Line 10—For *"which* resisted," read *"was* resisted."

Line 18—For "by means of *a*," read "by means of *the*."

Line 22—For "then they *are* washed," read then they *were* washed."

Line 34—For *"Kaolin,"* read *"cow dung."*

Line 35—For "some *sort of acetate*," read *"some arsenate."*

Line 41—For *"slid over,"* read *"passed over."*

Line 53—After "oxalate of ammonium," insert *'to the Turkey Red oil."*

Page 830, *Column One*:

Line 3—For *"The white became perfect,"* read *"The white which turned a yellow tint, became perfect on soaping."*

Line 11—For *"soda or silicate of soda,"* read *soda and silicate of soda."*

Column Two:

Line 19—For *"Propionic* Acid," read *"Propiolic Acid"*; omitting *"what we called."*

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
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CHEMICAL EDUCATION—A FACTOR IN INDUSTRIAL ADVANCEMENT

IT is now contended that the teaching of chemistry in our schools and universities has failed to keep pace with achievements in science and in industry. A Senate of Chemical Education is proposed to bring into closer co-operation the interdependent factors of chemical education and industry. This, evidently, is a move toward an entirely new conception of the teaching of chemistry in its more practical relation to industrial needs.

Out of 261 members of the Johns Hopkins Ph. D. Alumni who entered chemistry, 102 went into industry and industrial research. Industry should be always awake to new developments in the teaching of chemistry, for production in industry—and chemical processes are an integral part of production in scores of manufacturing enterprises—is raised to higher standards of efficiency and workmanship solely by individual effort. Individual effort, functioning in such a highly specialized, highly technical vocation as chemical manufacture, or in any work involving the application of chemicals, cannot possibly attain maximum effectiveness without a sound working knowledge of the particular branch of chemistry employed, reinforced by an acquaintance with the laws of science and the theories of chemistry in their broader aspects. The uneducated worker is too prone to boast of his practical experience, to put aside with a snap of his fingers any argument in favor of academic learning.

The essential difference between the plodding, unimaginative, indifferent worker and the ambitious, energetic, resourceful chemist is very frequently one of education. The one has not been sufficiently inspired by the subject he has chosen for his life's vocation. Somewhere down the line on his road to the mill laboratory the educational system that had undertaken to guide him to the door of his career fell short of its purpose. The other, the "inspired" one, is ever responsive to new ideas, ever seeking new knowledge that will make him more valuable to his employers and to himself; he has learned the importance of keeping well informed upon the new developments in his work; he has learned to look beyond the immediate task at hand to its larger significance in the system of things; he has learned to face ahead, to strive toward more creative effort, away from the prosaic routine that cramps the faculties and narrows the vision of the average laboratory worker, he has learned to cultivate those same priceless faculties and vision that enable the scientist to achieve the impossible.

Those in the business of making chemical products, those who use chemicals, should find much of significant interest in any plan to improve the underlying system of modern chemical education. The raw student from the academic laboratory comes to men in industry to offer his services for their interests. Whether he brings to their laboratories only a blind willingness to work under superiors who will always remain his superiors, or whether he brings the spirit, the vision, the ideals and the practical knowledge of the thoroughly trained chemist depends to a greater degree than they may believe upon the prevailing system of chemical education.

INCREASING THE DYER'S PROBLEMS

WHILE the work of the modern dyer is constantly being simplified by new methods, processes and products it also becomes more complicated with every new development in the production of artificial textile fibers.

The invention of an artificial wool, rumored about some time ago, has now become a subject of timely interest in the trade as two new products of this nature have entered the field. Sniafil, a textile perfected by a large Italian rayon concern, and described by some as "the nearest thing to wool ever seen," has been introduced to the American textile market with claims of its increasing consumption abroad to the extent of over 30,000 pounds daily. The other contender for wool's age-old title is a product of Meister, Lucius & Bruning, of Hoechst, and was first heard of when H. A. Metz returned from Germany a year ago. At that time it was in the experimental stage; but with the sudden revival of interest in imitation wools it is now actively competing for attention with similar products.

The dyeing properties of these fibers, we learn, closely resemble those of cotton. The Hoechst product, in fact, is cotton upon which wool-like effects are obtained by application of cold concentrated nitric acid. Mention is made of the fact that only unbleached cotton is suitable as its basic material.

There are, we may assume, various minor technicalities involved in the processing of these new fibers, all of which tend to increase the perplexities of the dyer, pressing upon him new responsibilities, and filling his days with nightmarish problems. His labors toward the light are perhaps embittered with imprecations upon those "pesky researchers" and ultra-scientific textile chemists who are responsible for these new-fangled novelties. He

undoubtedly feels that his skepticism is well justified when he finds himself wondering if progress in textile chemistry facilitates or complicates his daily tasks.

Realizing that any pretensions to versatility as a dyer would saddle him with the responsibility of meeting successfully every new problem, he at last turns to specialization in dyeing some one class of textiles. Yet even this move is ineffective in counteracting the evils of the prevailing hysteria for novelty, for the ability to dye silk usually presupposes equal facility in processing the artificial type—and now wool, too, has its pretender.

The bewildered dyer should find some consolation in the adage that man cannot propound a riddle that man cannot solve. Let new fibers come, for those who sire them shall also solve the riddles of their processing.

GRASSELLI ACTS TO PROTECT DYE PATENT RIGHTS

In action taken by Grasselli Chemical Company against the L. & R. Organic Products Company, Inc., in the United States District Court the defendant concern acknowledged importing and selling, without license from the patentee, dyes covered by United States patents of the Grasselli Company, but disclaimed intentional infringement. A satisfactory settlement was therefore arranged out of court in which the L. & R. Organic Products Company fully agreed to repay the royalties on all Grasselli colors it has sold since June, 1925, when the alleged infringement began, and to refrain hereafter from further infringement of this nature. The colors covered by the infringed patents were: Benzo Fast Red 8BL, Benzo Fast Bordeaux 6BL, Alizarine Rubinol 3G and Diazo Brilliant Green 3G.

As a result of this agreement no further action was taken by the Grasselli Chemical Company in this particular case, but it has stated that suits for similar infringement by other parties are expected to follow.

FRANKLIN PROCESS INSTALLS NEW WINDERS

The Franklin Process Company has recently installed in its Providence plant No. 90 Universal winders which will enable deliveries to mills of yarn on paper cops. The sizes of the cops regularly furnished at the present time are:

6½-in. cop with 6-in. traverse and 1 3/6-in. dia.

8-in. cop with 7 5/8-in. traverse and 1 3/6-in. dia.

8½-in. cop with 7¾-in. traverse and 1¼-in. to 1 3/16-in. dia.

This service, it is stated, should be of great interest to mills using fine single and two-ply cotton yarns for filling either silk or worsted fabrics.

It is stated that Universal wound cops contain from 50 to 75 per cent more yarn than ordinary bobbins and therefore reduce doffing time in proportion.

LOWELL TEXTILE CHRISTMAS EXERCISES

The features on the Christmas program of the Lowell Textile School this year included the rendering of a number of appropriate selections by both the orchestra and the glee club, and by a trio composed of Messrs. Holt, Howorth and Fox, an impressive address and a solo by the Rev. Edward S. Swift, S. J., assembly singing, and closing remarks by President Eames.

NEW VIOLET IN PONSOL SERIES

The Dyestuffs Department of E. I. du Pont de Nemours & Co. announce the production of another addition to their already extensive line of vat colors. This new product is a red violet offered under the name of Ponsol Red Violet RRNX Paste.

As this product is described as exceptionally fast to light, washing, water, cross-dyeing, chlorine, etc., even in very delicate shades, it can be used not only for the production of violets but also for pale bluish pinks or in combinations for mode shades or for red component in olive drabs for army cloths. In addition, according to the announcement, it dyes very evenly and is not affected by heat and moisture, thus overcoming the difficulties which arise when using some of the other vat violets.

The announcement of this product is especially interesting because this is the first time that it has been manufactured and offered by an American concern.

NEW NATIONAL SHADE CARD AND DYERS' FORMULAS

The National Aniline & Chemical Company, Inc., has just issued a new shade card, entitled "Direct Dyes for Cotton," showing a most important series of ninety-eight colorings on cotton yarn.

Besides the dyeings, which are shown in two shades, the book includes very full technical directions for the use of the individual dyes, covering twenty pages of test matter. There is also included an elaborate set of tables giving the fastness properties of each dye, which will enable the dyer to make his selections to meet every condition that is presented to him in the dyehouse.

The volume is substantially bound and will prove to be an important addition to the working library of every cotton dyehouse.

National has also issued the latest edition of Dyers' Formulas for use in connection with the new 1926 Spring Shade Card issued by the Textile Color Card Association. Formulas for all of the 120 spring shades are given, simplifying to a degree only appreciated by a dyer the problem of matching next season's most popular shades.

ACETATE SILK—ITS DYES AND THEIR APPLICATION

(*Continued from page* 850)

dye bath may also contain salts, acids or protective colloids.

Fast greenish-yellow shades on acetate silk, which are not phototropic, may be obtained by means of monoazo dyestuffs prepared by coupling 1, 3-dihydroxyquinoline with diazotized aniline or its homologues or derivatives, particularly halogenated aniline and toluidines, as described in British Patent No. 11,205 (1905). This process is covered by British Patent No. 236,037, June 20, 1924, to Baddiley, Hill and the British Dyestuffs Corporation. This patent may cover Dispersal Yellow 3G of page 589, Part XIII.

(*Part IV will appear in an early issue.*)

BRITISH PIECE DYERS' ASSOCIATION DEFENDS ITSELF

At a recent meeting of the Committee on Industry and Trade, witnesses stated that the Piece Dyers' Association was the outcome of acute price cutting, which had obtained to such an extent that businesses were conducted on the lowest possible margin of profit, or even at actual loss. Firms in the trade were thus driven to co-operate to prevent individual disaster or collective impoverishment. It was submitted that the Piece Dyers' Association and similar price associations were comparable with trade unions. In each case they were the outcome of extreme exploitation in the past, and constituted some defense against any new tendency in that direction. The Association had had a marked effect on the general efficiency of the dyeing trade, and the intercourse between members had been of benefit to the consumer, inasmuch as it had synchronized with a higher quality of the finished article. Competition for orders remained keen, but its basis was quality and service rather than price. As much of the skill of the finisher had now to be devoted to making the appearance of a lower grade of cloth approximate to that of a higher quality, it was claimed that, by the exercise of ingenuity, finishers had met the desires of their customers in this respect, and to that extent had contributed considerably to the cheapening of textile piece goods.—The Dyer & Calico Printer.

NEW NEWPORT SCARLET

A leaflet recently issued by Newport Chemical Works, Inc., describes the properties of Newport Fast Light Scarlet EG, a color said to be conspicuous for its excellent fastness to light and its good level dyeing properties. These features make it especially useful for dyeing wool in many stages of manufacture, either as a self-color or for compound shades in combination with other level dyeing types. It is also of interest for dyeing pinks fast to stoving and light. Its fastness to rubbing, stoving and steaming is described as very good. It will discharge.

CELLIT FAST COLORS CARD

The General Dyestuff Corporation has recently issued a new shade card exhibiting on bows of pure acetate silk and of cotton and acetate silk and on swatches of printed goods of acetate silk and cotton, the full line of Cellit fast colors for dyeing acetate silk. The text of the card explains how the various effects were obtained and gives dyeing percentages, etc.

Another new card issued by the General Dyestuff Corporation shows dyed swatches of velour hat material with complete dyeing formulas for each of the twenty-seven shades. The Cellit fast colors and those used on the velour are manufactured by Farbenfabriken vorm. Friedr. Bayer & Co.

STEIN-HALL SALES CONVENTION

The annual convention of the salesmen and representatives of Stein, Hall & Co., Inc., was held December 16 to 19, inclusive, at the offices of the company, 61 roadway, New York. After a thorough discussion of business problems and plans, the men were guests of the company at a theater party on the night of the 18th. Representatives were present from Boston, Providence, Troy, New York, Philadelphia, Charlotte, Greenville, Atlanta, and Detroit.

The New York offices of Stein, Hall & Co., Inc., will be removed on or about January 9 from 61 Broadway to the new Murray Hill Building, 285 Madison Avenue, where the entire 21st floor will be occupied.

Electro Bleaching Gas Company announces the promotion of Wm. J. Weed to the position of assistant manager of sales of that organization.

Mr. Weed has been a member of the Electro Bleaching Gas Company staff and their associate company Niagara Alkali Company, for the past thirteen years. His broad general background equips him admirably for his new role, especially because of the six years which have been devoted almost entirely to the pulp and paper field, in which industry he is widely and favorably known.

RECENT LITERATURE

An Idea—and What Came of It. Franklin Process Company.

A small, attractively bound and printed booklet giving the interesting story of the new Franklin Process Raw Stock Dyeing Machine, from the inception of the idea to its development and final realization, with a clear description of the construction of the machine, its specifications, main features, operation and efficiency. The booklet is well illustrated with photographs of installations and diagrams of the working parts of the machine.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

ANTHRENE BLUE GC

(Schultz No. 843)

COMPOSITION: Mixture of di- and tribrominated Indanthrene Blue RS.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Caustic and hydro at 120 deg. Fahr. Requires plenty of caustic to get maximum effect. Ten per cent is better than 5 per cent for medium shades.

SHADE: Greener than GCD.

SHADE BY GASLIGHT: Grayer.

SOLUBILITY: Moderate.

LEVEL: Dyes level only with care.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Fast.
Alkali: Fast.
Chlorine: Strong treatment makes shade lighter. One deg. Tw hardly affects the shade.
Fulling: Fast.
Ironing: Fast.
Light: Type for Class VIII (German Classification).
Perspiration: Fast.
Rubbing: Fast.
Washing: Fast.

MACHINE DYEING: Suitable but must be used quickly when reduced as it tends to precipitate on standing. GCD bttter in this respect.

DYED BY OTHER METHODS: Cold; not suitable.

PRINTING: Not suitable.

DISCHARGING: Does not strip.

COMPETING PRODUCTS: Made in the United States by Newport Chemical Works, Inc., under the name of Anthrene Blue GC.

INDANTHRENE GRAY B

(Schultz No. 848)

SPECIALLY SUITABLE FOR: Cotton.

SHADE: Gray.

LEVEL: Not particularly good.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Fast.
Alkali: Very fast.
Boiling: Fast.
Chlorine: Slight.
Fulling: Fast.
Ironing: Fast.
Light: Fast.
Rubbing: Fast.
Washing: Fast.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under name of Amanthrene Gray B and G.

INDANTHRENE YELLOW G AND R

(Schultz No. 849)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Caustic and hydro at 140 deg. Fahr. Will also dye cold and at 190 deg. Fahr. The dyeing method is not much affected by the per cent of caustic and hydro. Shade is intensified by afterchroming.

SHADE: G a bright yellow; R a reddish yellow, similar to Chloramine Yellow.

SHADE BY GASLIGHT: Slightly redder.

SOLUBILITY: Good with caustic and hydro. Violet solution when reduced.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Excellent.
Alkali: Excellent.
Boiling: Akali; moderate, though better than Primuline after-treated with chloride of lime.
Chlorine: Fast.
Ironing: Fast.
Rubbing: Fast.
Washing: Excellent.
Bowking: Type for Class III (German Classification).

SENSITIVE TO METALS, LIME: The shade of the vat is violet and the cotton is also colored violet at first. After dyeing one-half to three-quarters of an hour the bath is exhausted and the cotton then oxidizes from violelt to light yellow.

DYED BY OTHER METHODS: May be topped with 3 to 4 ounces of chrome to develop the shade. Machine dyeing: suitable. May be dyed with sodium sulphide and used to shade sulphur colors. Algol Yellow R (S-817) is a little clearer and faster to light.

ON OTHER MATERIALS, PAPER: Used as a body, i. e., in fine suspension; fast to light, acids and alkalies. Add color to the pulp before sizing.

LAKES: Suitable.

PRINTING: Suitable by all processes.

COMPETING PRODUCTS: Made in the United States by Newport Chemical Works, Inc., under the names of Anthrene Yellow G and R; E. I. Du Pont de Nemours & Co. under the names of Ponsol Yellow G and GG.

ALIZARINE BLUE SAE

(Schultz No. 858)

SPECIALLY SUITABLE FOR: Wool yarn and pieces.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Redder than SAP.

SHADE BY GASLIGHT: Redder

SOLUBILITY: Good.

LEVEL: Inferior to SAP.

EXHAUSTS: Inferior to SAP.

FASTNESS TO:

Acid: With muriatic, a pure yellow; sulphuric 1-10 turns it slightly redder.
Alkali: With 20 per cent ammonia, trifle greener.
Fulling: Fair
Ironing: Fast; turns slightly greener.
Light: Same as SAP.
Perspiration: Better than SAP.
Rubbing: Fast.
Sulphur: Fast.
Washing: Moderate.

SENSITIVE TO METALS, LIME: Changes more under the action of chrome than SAP.

OTHER PROPERTIES: Can also be used for the dyeing of wool and silk fabrics and as is the case with SAP the silk is only tinted.

DYED BY OTHER METHODS: In contrast to SAP the SAE may be used for combinations which are not affected when exposed to the action of fluids containing salt. The SAE is not as level dyeing as the SAP but with care good good results may be obtained. It is well to start the dyeing with acetic acid.

PRINTING: Printed on slubbing (acid) gives a reddish blue. With acetate of chrome a greenish blue. Dyed on wool the shade can be discharged red with zinc dust. It cannot be discharged with tin or hydro.

COMPETING PRODUCTS: Made in the United States by National Aniline & Chemical Company, under the name of Alizarine Sapphire SE; E. I. Du Pont de Nemours & Co., under name of Alizarine Saphirol SE; Grasselli Dyestuff Corporation, under name of Alizarine Blue SAE; Calco Chemical Company, under name of Alizarine Blue SAPX.

ALIZARINE GREEN CG EXTRA

(Schultz No. 865)

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Acid-top and bottom chrome.

SHADE: Pure shade of green, not as blue as GXN.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Excellent.

LEVEL: Excellent.

EXHAUSTS: Superior to Anthraquinone Green GXN (S-864).

FASTNESS TO:

Acid: Fast.
Alkali: Fast.
Carbonizing: Fast.
Fulling: Class II to III (German Classification).
Ironing: Goes slightly bluer.
Light: Excellent; Class VII to VIII (German Classification).
Perspiration: Fast.
Rubbing: Fast.
Steaming: Fast.
Washing: Class III (German Classification).

OTHER PROPERTIES: Suitable for men's wear piece dyes. Largely used for carpet yarns.

DYED BY OTHER METHODS: Top chrome has better fastness to alkalies and washing. Inferior as a feeding-on color to GXN.

ON UNIONS: Gloria: Both fibers covered equally. Cotton effect threads left white

ON OTHER MATERIALS: Silk: Not particularly fast to water on this fiber.

COMPETING PRODUCTS: Made in the United States by Chemical Company of America, under name of Alizarine Cyanine Green CG; Newport Chemical Works, Inc., under name of Acid Alizarine Green C; Ultro Chemical Company, under name of Alizarine Green CG.

ANTHRENE BROWN BB 20% PASTE

(Schultz No. 867)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Caustic and hydro at 140.

SHADE: Dull greenish brown.

LEVEL: Good; dyes very slowly.

EXHAUSTS: Does not exhaust well.

FASTNESS TO:

Alkali: Sufficiently fast.
Chlorine: Destroyed.
Cross-Dyeing: Fast.
Ironing: Fast.

(Continued on page 897)

FULLERS' EARTH

Composition, Origin and Properties—Uses on Textile Materials

THE main employment of fullers' earth to-day is for the decolorizing of oils and fats, and it is used to a very important extent for the refining of petroleum. On account of their excellent properties for the purpose, certain varieties have been found to be suitable for the production of distempers. In the textile trade fullers' earth is not used to the same extent as it was a generation ago, and yet it is still employed to a most important degree in the cleansing of textile materials. It is a favored agent for cleaning indigo dyed goods, and for the removal of loose color from logwood dyed blacks and from other shades which are produced from the natural dyewoods. Among present day detergents it occupies a relatively unimportant place. Soap in its efficiency is vastly superior as a cleansing agent and yet fullers' earth fills a niche in textile processing where soap would probably not be satisfactory. Indeed, modern science as applied to the washing and cleansing of textile materials has had its attention drawn to the utility of such bodies as fullers' earth, china clay, soapstone or talc, and other clays and the results of researches have given a very much increased interest in these substances.

Earthing Textile Materials

In the textile trade fullers' earth was the forerunner of soap, and the old name for milling—"fulling"—doubtless took its name from the use of the fullers' earth in the process. Sometimes yarns and pieces are scoured in the earth and then are sent to be dyed without any further treatment in the shape of washing. Piece goods dyed in the grease are commonly treated in this way. A small amount only of the oils and fats present in the material is removed and unless the dyer is accustomed to getting bulk orders he runs a serious risk of rapid deterioration of his press papers, due to the heat of the presses melting out the remainder or a part of the remainder of the oil left in the fabrics. In some respects, however, apart from the slightly increased weight of the goods when finished (as compared with the weight given by scouring in the usual way with soap, etc.), there is probably also an improved handle; while for crossbred material of low qualities—these being the cloths which are mainly treated in this way—there may be something to say for this cheaper scouring process.

There is another point, however, which should not be lost sight of, and that is, that such "earthed only" goods, containing as they do a small amount of oils and fats in them when finished, are much more liable to wear dirty by rapidly taking up dust which naturally clings to the oils and fats still in the material. For the finisher, in view of the liability to cause deterioration of the press papers, the method of earthing instead of a thorough scour with soap, etc., may cause the process to run out actually dearer, unless he is constantly using this method of washing his goods.

Composition, Origin, and Properties

In textile technology, fullers' earth is often only given a very restricted space, and yet it is a most interesting type of detergent compound. It is a kind of porous clay possessing absorptive properties. Chemically, such compounds are hydrated aluminum silicates with varying small amounts of the oxides of iron, calcium, magnesium, etc. They possess the property of absorbing grease and may be used for filtering oils. When examined under the microscope they are seen to be both crystalline and amorphous in structure.

Earths from different localities vary in their absorbing properties and so far as the decolorizing of oils is concerned some will be found to be suitable for vegetable and others for mineral oils. The earth itself may retain some of the oil, which is one of its disadvantages.

It is found in various places in this country, notably in Cornwall, Surrey and the West of England, while in the United States large deposits in various districts are being worked commercially.

There have been several attempts in recent years to improve the use of these clays and earths with varying success. Some of the compounds and preparations may be excellent, but others, for textile purposes, undoubtedly are not. Because the product looks whiter than fullers' earth, it is not necessarily equally satisfactory for the purpose of scouring, etc. In the actual testing of such there must be no residual dusting of the material or trouble will arise either in the dyeing which may follow or in the faulty appearance of the goods when they are being finished.

In textile work, soap-bark (Quillaia or saponin extract) is commonly added to the bath for the production of foam. In certain cases also myrabolams or other tannin matter is added.—The Textile Argus.

GENERAL DYESTUFF ABSORBS KUTTROFF, PICKHARDT & CO. SALES DIVISION

Formal notice has been issued that, effective January 1 Kuttroff, Pickhardt & Co., Inc., will discontinue the importation and sale of dyestuffs. The General Dyestuff Corporation, now located at 230 Fifth Avenue, New York, has purchased the merchandising stock of Kuttroff, Pickhardt & Co., and will hereafter offer to the trade the dyestuffs manufactured by the Badische Anilin und Soda-Fabrik, Ludwigshafen o. Rhine, as well as the other dyestuffs which the former company supplied.

Joseph Galli, president of the J. Galli Dyeing Company, Inc., Paterson, N. J., is said to be planning a large addition to the plant. The Galli Company, which dyes both rayon and silk ribbons, was formed last June after Mr. Galli had purchased the plant of the Stanley Silk Dyeing Company. He was for many years an expert with the National Silk Dyeing Company at Paterson, and has as partners John Pomfret, Jr., and Blanche Franchi, both of Paterson, and Sidney J. Turner, of Totowa Borough.

The Du Pont Company, Wilmington, Del., has sent to employees announcement of its stock investment plan under which employees may start the accumulaltion of income-producing property by subscribing for the 6 per cent cumulative debenture stock on advantageous terms. The stock is offered at $98 a share and will pay, in addition to the regular dividend, $3 a share for five years if the holdler remains in the employ of the company during that period. It can be purchased on a monthly payment plan, or in full, in the proportion of 20 per cent of the employee's yearly salary or wage but no more than ten shares can be purchased by any one employee.

The Michigan Alkali Company, 21 East Fortieth St., New York, has issued its general price list for 1926, as follows:

	Per 100 lbs.
Caustic Soda	
Solid 76 per cent in large drums	$3.10
Flake 76 per cent in large drums	3.50
Crystal 76 per cent in large drums	3.50
Light 58 Per Cent Soda Ash	
In bulk	1.25
In bags	1.38
In barrels	1.63
Dense 58 Per Cent Soda Ash	
In bulk	1.35
In bags	1.45
In barrels	1.69

Spot cars of soda ash 5 cents per 100 pounds higher. Spot cars of caustic soda are 10 cents per 100 pounds higher. All prices are for shipment in carload lots. F. o. b. works, Wyandotte, Mich., with usual freight equalization.

A new dyeing and finishing plant will be established at Burlington, N. C., by the Southern Dyeing Company, and it is understood that the company will specialize in work for the hosiery mills in that city. The new company will be headed by E. W. Sweet and W. L. B. Garrison. Mr. Sweet is president of the Southern Artsilk & Dye Works, which was established at Burlington, last year, and Mr. Garrison is secretary and treasurer of the same company.

The Hamilton Silk Mills, 452-458 East Nineteenth Street, Paterson, N. J., have been organized to buy, sell, manufacture, work, prepare, treat and in all ways handle and deal in raw, thrown and manufactured sillk, wool and other yarns, and textile fabrics of all kinds. Capital, $100,000; par value, $100. Morris and Mary Goldhamer, and Morris and Rae Gold, all of Paterson, hold a total of 250 shares.

GEORGE EDWARD TEMPLETON

George Edward Templeton, general manager of the Brock Woolen Company, Ltd., Simcoe, Ontario, Canada, died most suddenly on Monday, December 21, at the General Hospital, Hamilton, Ontario, as a result of an operation.

Mr. Templeton was a native of North Adams, Mass., was in his 38th year and had been identified with dyeing and finishing operations in both this country and Canada during his entire life.

Mr. Templeton will be remembered by readers of The Reporter as the author of the "G. E. T." column which we published for quite an extended period some years ago. His many friends among the textile-chemical fraternity join with The Reporter in a feeling of profound sorrow at his sudden and unexpected death.

DYESTUFF TABLES

(Continued from page 895)

Light: Not particularly good for a vat dye.
Washing: Very good.
Bowking: Poor.

MACHINE DYEING: Suitable.

DYED BY OTHER METHODS: Will also dye with sodium sulphide.

PRINTING: Prints are rather weak and used mostly as a shading color.

COMPETING PRODUCTS: Made in the United States by Newport Chemical Works, Inc., under name of Anthrene Brown BB.

INDIGO

(Schultz No. 874)

SPECIALLY SUITABLE FOR: Cotton and wool.

USUAL METHOD OF DYEING: In hydrosulphite vat.

SHADE: Redder and duller than S-881.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Good.

LEVEL: Inferior to S-881.

EXHAUSTS: Dyed in dips.

FASTNESS TO:
Acid: Excellent.
Alkali: Excellent.
Carbonizing: Excellent.
Chlorine: Not equal to S-881.
Cross-Dyeing: Fast.
Fulling: Excellent.
Light: On cotton similar to S-881.
Perspiration: Fast.
Rubbing: Like natural indigo.
Sulphur: Fast.
Washing: Fast.

DYED BY OTHER METHODS: This color must be dyed cold. For 50 grains of cotton yarn in a liter bath use the following 10 grains of Indigo 20 per cent paste: 8 cc. caustic, 25 deg. Be., 20 cc. boiling water, .6 cc. hydro. Dye in this vat till the solution shows a golden yellow. Cotton yarn is dyed in three twenty-minute dips. In comparison with this color the Brom Indigo (S-881) can be dyed in a hot bath as better penetration can thus be secured.

COMPETING PRODUCTS: Made in the United States by E. I. Du Pont de Nemours & Co., under names of Indigo 20% Paste and Indigo Powder J; Dow Chemical Company, under name of Indigo Synthetic; National Aniline & Chemical Company, under names of Indigo NAC 20% paste and Indigo NAC Powder.

MIDLAND BLUE R

(Schultz No. 880)

SPECIALLY SUITABLE FOR: Cotton and wool.

USUAL METHOD OF DYEING: Hydrosulphite vat at 140 deg. Fahr.

SHADE: Redder and duller than S-881.
SHADE BY GASLIGHT: Redder and duller.

SOLUBILITY: Inferior to S-881.

LEVEL: Inferior to S-881.

FASTNESS TO:
Acid: Equals S-881. Fast.
Alkali: Fast; equals S-881.
Boiling: Good; equals S-881.
Chlorine: Moderate; like S-881.
Cross-Dyeing: Stands cross-dyeing.
Fulling: On wool very fast to fulling.
Ironing: Good.
Light: Superior to S-881.
Perspiration: Fast.
Rubbing: Crocks.
Washing: Same as S-881. Very good on wool and silk.

ON OTHER MATERIALS: Adapted for wool dyeing. Printing: In printing this color it should be done with Rongalite C, potash or hydro and lye. The prints are very fast to soaping and fairly fast to chlorine. Light and medium shades which have not been soaped are easily discharged with chlorate.

COMPETING PRODUCTS: Made in the United States by Dow Chemical Company, under name of Midland Blue R

CIBA BLUE 2B

(Schultz No. 881)

SPECIALLY SUITABLE FOR: Cotton and wool.

USUAL METHOD OF DYEING: In the hydrosulphite vat.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Good.

LEVEL: Excellent.

EXHAUSTS: Well.

PENETRATION: Excels 874.

FASTNESS TO:
Acid: Excellent.
Alkali: Excellent.
Chlorine: Fast.
Ironing: Fast.
Light: On cotton same as 874.
Rubbing: Better than Indigo.
Steaming: Redder and duller.
Sulphur: Fast.
Washing: Fast.

ON OTHER MATERIALS: Silk: Very well adapted on account of its excellent fastness to water and boiling and soap. Used for silk decoration threads which are to be cross-dyed.

COMPETING PRODUCTS: Made in the United States by Dow Chemical Company, under name of Ciba Blue 2B.

DYEHOUSE OVERSEER

WANTED—Dyehouse overseer, thoroughly familiar with the handling and dyeing of piece goods, including glove silk, wide tubular and woven broad silk goods. Must be real, live man, capable of getting quality and production, able to handle and train labor and generally organize a dyehouse to run economically. State age, experience and salary required to Box 323, American Dyestuff Reporter.

PRINT WORKS CHEMIST

Experienced textile print works chemist and colorist, university graduate, desires position. Middle aged, married. References. Address Chemist, 66 Marlboro Street, Newton, Mass.

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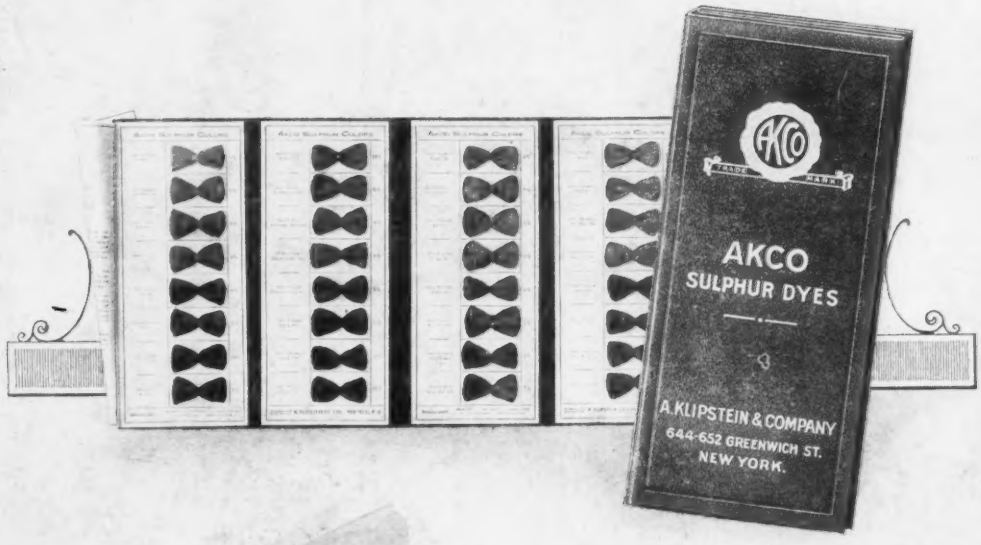

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